THE GEOGRAPHICAL JOURNAL

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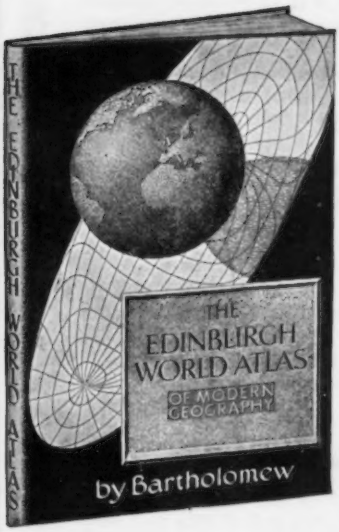

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DANCERS OF GOD. *Films and commentary by Noel Ballif. Unique films of Pygmy life by the leader of the Ogowe-Congo Expedition*

Monday October 31 at 8.30 p.m.

PROBLEMS AND PROSPECTS OF WORLD AIRLINE DEVELOPMENT. *By Sir Miles Thomas*

Monday November 7 at 8.30 p.m. At the Royal Festival Hall

KANCHENJUNGA CLIMBED. *By Charles Evans and George Band*

A joint Meeting with the Alpine Club. Admission by special ticket (for Fellows and Associate Members, with one guest only) will be in order of receipt of application, to be made on the card provided. Closing date: October 10

Monday November 14 at 5 p.m.

SCIENTIFIC RESEARCH BY THE NORTH GREENLAND EXPEDITION. *By R. A. Hamilton and others*

Monday November 21 at 8.30. p.m.

ALONG THE MALABAR COAST. *By Mlle. Ella Maillart*

Monday December 5 at 5.30 p.m.

LIVINGSTONE'S COUNTRY. *Colour films with commentary by Major J. Waller, including a remarkable sequence of the Victoria Falls, discovered by Livingstone 100 years ago*

Monday December 12 at 8.30 p.m.

THE ORDNANCE SURVEY AND THE PUBLIC. *By Major-General J. C. T. Willis.*

This discussion, by the Director-General of Ordnance Survey, of the problems of mapping to meet public needs, will be accompanied by an Exhibition of the latest O.S. Maps, on view from November 21 until December 20

Monday December 19 at 5 p.m.

BETWEEN TWO FORESTS. *By Professor S. W. Wooldridge and Miss E. M. J. Campbell. A geographical appreciation of the site and situation of London*

After Evening Meetings at the Society, light refreshments will be served to Fellows, Associate Members and their guests.

Nominations are invited from Fellows who may wish to make proposals for membership of the Council of the Society for 1956–7. They should be received, if possible, by January 15.

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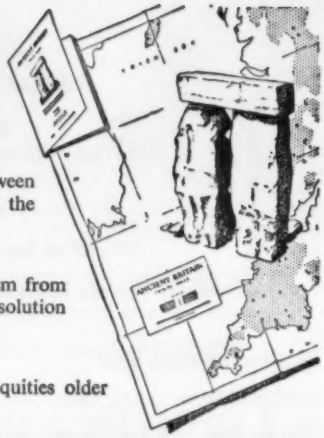

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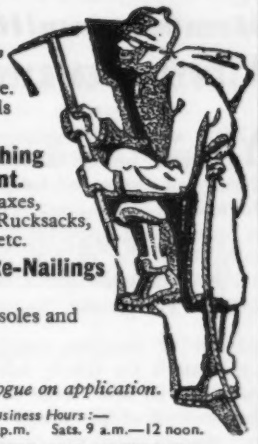

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Vol CXXI Part 3 *September 1955*

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SIR JAMES MARSHALL-CORNWALL, K.C.B., ETC.

IT IS MY first and most pleasant duty to offer, on behalf of our Council and Fellows, a very warm word of welcome to our Honorary President, Her Royal Highness the Duchess of Kent, who last honoured us with her presence five years ago. We are well aware of the number of duties incumbent upon all members of the Royal Family, particularly at this season of the year; and I speak for all our Fellows and Members when I say how greatly we appreciate these visits by Your Royal Highness, and the continuing interest which Your Royal Highness has always shown in our activities and which is so great an encouragement to us.

It is recorded in our annals that, over a hundred years ago, one of my more eminent predecessors in office, when making his first Presidential Address to the Society, held his audience enthralled for the space of two hours. I do not propose to emulate his example, but this year is our 125th Anniversary, so I feel bound to say a few words about the quarter of a century which has elapsed since our Centenary in 1930.

The most distinguished of all British geographers, the late Sir Halford Mackinder, said in the Silver Jubilee Address to this Society in 1935: "The Royal Geographical Society is not only one of a group of learned societies, but also a representative institution in the wider life of the Nation." At no time has this been more evident than in the manifold activities of our Society since 1930. In the field of public affairs, the Society's important services to the Departmental Committee on Ordnance Survey, and to the Royal Commission on the Distribution of Industry, in 1938, were good examples of the way in which it has been possible for the Society to influence important developments in the national life.

In the field of scientific and technical research we were, before the war, foremost in stimulating the advances in the new technique of stereo-photogrammetry. This has since become of vital importance in conducting those great surveys of land from the air which are now an indispensable basis for all economic planning, especially in our under-developed territories overseas. We have also continued to promote and to foster the advance of geographical education, both in the universities and in the schools, there following up the pioneer work of Freshfield, Galton and Scott Keltie, which led to the foundation, at the turn of the twentieth century, of the first Departments of Geography at Oxford and Cambridge. Our close concern with geographical studies in the universities was shown by the inauguration in 1945 of a new Research Series of publications designed to include, not only highly technical studies characteristic of the pre-war Technical Series, but also to encourage the examination of what Sir Halford Mackinder called "the causal relation

of physical features," so as to make geography, as Mackinder also said: "a bridge between the natural sciences and the study of humanity." This widening of scope has been mirrored in the content of our *Geographical Journal*. There the work of university geographers has found and will, I hope, continue to find an increasingly prominent place.

But it is, perhaps, through its support and sponsorship of exploration that our Society has become best known to the general public. In this respect, the last twenty-five years have certainly been remarkable. H. G. Watkins's Arctic Air Route Expedition of 1930–31 blazed the trail for the great commercial trans-polar flights linking Europe and North America, which have just started. In the Antarctic, the British Graham Land Expedition, under John Rymill, made the first extensive surveys of that continent, and pointed the way to the remarkable development of British Antarctic exploration, which has been such a feature of the post-war years. In the Libyan desert, the motorized expeditions organized by Ralph Bagnold, and his study of sand-dune formations, led to the war-time exploits of the Long Range Desert Group. Since the War, and in another desert area, south-eastern Arabia, Wilfred Thesiger's crossing by camel of the Rub' al Khali, the famous "Empty Quarter," and his other travels in that part of Arabia, rank with the greatest achievements in Arabian exploration; his surveys led to the publication by the Society of a unique map of the whole region.

The Second World War naturally hampered our activities, but within the last ten years there have been several large and notable expeditions, landmarks in the history of exploration. First, mention must be made of the Anglo-Scandinavian Expedition to the Antarctic in 1950–52. This, in terms of scientific results, has been one of the most successful polar expeditions supported by the Society. The North Greenland Expedition of 1952–54, under the leadership of Commander Simpson, is especially noteworthy as marking the revival of Naval interest in polar exploration, which our Founders did so much to foster. Then, of course, there was Everest, of which perhaps almost enough has been said; here, in the preparatory expeditions of 1951 and 1952 and in the final triumph of 1953, our Society not only acted as sponsor, but also took a substantial part in the work and organization of the home base. The same applies to the conquest of Kanchenjunga, achieved in the past month.

In concluding this brief survey of the highlights of the past, some reference must be made to the remarkable post-war expansion of our Fellowship, and of our Associate Membership since that was first instituted in 1947. The last ten years have proved a period of unparalleled economic pressure on the individual taxpayer. This has been especially hard for learned societies like ours. It is all the more remarkable, therefore, that our Fellowship (5000 in 1945) has, since 1948, never once dropped below 6000, and now stands at 6508. Similarly, our Associate Membership for young people has, in the eight years since 1947, reached above the 200 mark. The combined total of membership of all kinds is today 6726.

I must now turn to the events of the past year and, following the practice of my predecessors, mention the losses which this Society has recently suffered. The death in November last of Sir Edward Keeling deprived us not only of an officer of this Society of many years standing, but also of a wise counsellor in financial and other matters. Exploration lost a famous name in Lieutenant-General Edward Felix Norton, who died in the same month. He was a Gold Medallist whose name will be enshrined for ever in the history of Mount Everest. Academic geography has also suffered grievous loss through the death of Dr. Howarth, Secretary of the

British Association for many years, and President of the Geographical Section at its Centenary Meeting at Edinburgh in 1951.

Outstanding among the meetings of this Session, which have continued to attract large audiences, was Commander Simpson's lively lecture on the North Greenland Expedition. This was held at the Royal Festival Hall last November and was graced by the presence of our Patron, Her Majesty The Queen, and by H.R.H. The Duke of Edinburgh. At that lecture I announced that His Royal Highness had consented to accept Honorary Membership of the Society. As Patron of the Mount Everest Expedition and of the present Expedition to Kanchenjunga, the Duke of Edinburgh has shown an active interest in our affairs. His acceptance of Honorary Membership is a great encouragement to us and is in keeping with his evident concern to stimulate the spirit of exploration, of enterprise and adventure among our young people.

Exploration this year, supported or organized by the Society, has again been on an increasing scale. The most notable large expedition is the party, under the leadership of Charles Evans, which set out to explore and has just succeeded in scaling Kanchenjunga, the world's third highest mountain, hitherto unclimbed. This Expedition, with its headquarters established in our House, was sponsored jointly by your Society and the Alpine Club. Another expedition, in whose promotion your Society has from the start taken a prominent part, is the projected Commonwealth Trans-Antarctic Journey. Under the leadership of Dr. Fuchs, the advanced guard of the Expedition plans to leave this country in November or December this year. All being well, it will establish a base in Coats Land on the Weddell Sea, spend the winter there and then, reinforced the following year by a larger party, will attempt a first crossing of the continent by land, by way of the South Pole, to the Ross Sea coast. This you may remember was in fact the plan contemplated by Shackleton on the eve of the First World War, but that expedition came to an unhappy end. This great project of land exploration in the Antarctic, therefore, still remains to be achieved.

This year, no less than sixteen university expeditions have received grants from the Society: for work in Borneo, in the Arctic, in the Belgian Congo, in French Morocco, in Afghanistan and in the Himalaya, in the Antarctic and in an uninhabited South Atlantic island—Gough Island. In addition to grants from the Society amounting to nearly £2000 and the loan of survey instruments, several of these expeditions have also received grants from the Geographical Magazine Trust Fund. These latter grants have amounted to a total of about £800 in 1955, a remarkable example of the continued assistance given by the Magazine to geographical exploration and research.

I have not included in this summary the large number of expeditions, mainly to the Himalaya, which the Society, together with the Alpine Club, has supported through the medium of the Mount Everest Foundation. The Mount Everest Foundation, referred to by my predecessor last year, was officially established in January last. The work of the Foundation is conducted by a Committee of Management under Mr. Wordie's chairmanship, which is composed of an equal number of representatives of the Alpine Club and of this Society, acting as Trustees. These Trustees are advised as to the most deserving recipients of the Trust benefactions by a Selection Committee which initially considers applications for grants. The objects of the Foundation, which I hope will become more widely known in geographical and scientific circles, are not only exploration in mountain regions primarily by mountaineers, but also the support of field research in a very wide

range of sciences for which the mountainous parts of the world offer special opportunities. I am happy to say that the funds of the Foundation, consisting of the proceeds from the many books, photographs, lectures and films on Everest, continue to increase, and have now reached a very substantial figure. Research and exploration in mountain regions should, therefore, be relatively well provided for in the future.

I wish that I had time to describe to you in detail the constructive work accomplished by the six main committees which plan and execute the ideas and policy evolved by our Council. These are the Research and Expeditions Committee under Mr. Wordie's chairmanship, the Education Committee (Dr. Briault), the Publications Committee (Dr. Hindle), the Library and Maps Committee (Lord Nathan), the Survey and Instruments Committee (Major-General Brown), and last, but not least, the Finance and House Committee, under our Honorary Treasurer, Mr. Brooks, who has continued to handle in a masterly way our manifold administrative problems.

The increase in our annual subscription has, for the time being, saved us from a substantial deficit. Overall economies have indeed enabled us this year to report a small surplus of income over expenditure. But economies are not necessarily good policy if we are to continue to expand our activities. It was with this in mind that your Council recently obtained the approval of the body of our Fellows to the institution of Corporate Membership, and to the provision of wider powers for the investment of the Society's funds. It is perhaps not generally known to what extent the Society provides geographical information at short notice to commercial and industrial and other organizations, and I hope that, quite apart from any desire to promote the Society's cause, these bodies may welcome the opportunity, now available to them for the first time, to make some regular financial acknowledgement of these services by becoming Corporate Members. Demands on our resources are not only heavy for the support of a steadily mounting number of expeditions, but also for the ever increasing cost of scientific publication. Costly repairs and improvements to the House are also having to be faced, and in some cases they are long overdue. Chief among the improvements is the urgent need for better lighting, especially for the benefit of students and members of the public who use the unrivalled resources of our Map Room. Improvements in heating are also very necessary, and especially the replacement of coal fires by labour-saving and smog-saving electricity. All these we are bound to undertake, despite the heavy cost involved.

We must therefore seek new sources of revenue in Corporate Membership, by increasing our investment income, and also, especially, in benefactions and donations. We need the means to expand, and we must expand if we are to fulfil our obligations. But, at the same time, in appealing to an ever widening circle for support, we must not fall below the high scientific standards set by our Founders.

That, briefly, is the problem that confronts us in this, the 125th year of our history. It is one which I am confident we shall solve, so that we may continue to flourish, not only as a learned Society, but as an important "institution in the wider life of the Nation."

THE ASCENT OF K2

PROFESSOR ARDITO DESIO

THE IDEA OF the Italian expedition to K2, which I had the honour of organizing and leading, under the auspices of the National Research Council and of the Italian Alpine Club, came into my mind as far back as 1929. In that year I took part as a geographer and geologist in the Duke of Spoleto's expedition, and was able to examine the enormous mountain from its nearest approaches, and to study the possibilities of climbing it. The Spoleto Expedition had also left several scientific problems open which needed clearing up.

In 1936 I discussed the matter seriously with some friends, and by 1939 I had succeeded in drawing up a plan with the support of the Italian Alpine Club. The war suspended all such activities, but in 1949 I began to see my way to realizing my dream in spite of the serious difficulties, especially economic ones, in the way of such undertakings. Finally, in 1952, the Italian National Olympic Committee placed the necessary funds at my disposal for a preliminary reconnaissance in Pakistan. But an unexpected obstacle dashed my hopes: permission had already been granted by Pakistan to Dr. C. Houston, head of an American expedition, and for supply and transport reasons another permit could not be issued for the same year. I was obliged to content myself with applying for permission to make only a preparatory journey in 1953, with a view to conducting a full-scale expedition to the Baltoro Mountains in 1954; this latter would be a twofold project, with a scientific as well as a mountaineering programme. We hoped to achieve the ascent of K2. The negotiations went through varying vicissitudes of hope and disappointment lasting almost a year until, in the middle of July, when things looked very black, I learned that the permit for the preliminary expedition had been granted.

The Karakoram Range is on the same latitude as Gibraltar and is, broadly, the section of the Himalaya furthest from the sea. For these reasons its climate is somewhat different from that of the Himalayan area best known to the public—that of Nepal, where rises Mount Everest, the highest peak in the world (29,028 feet). The famous monsoon, the humid summer wind, only affects the Karakoram to a small degree, and it arrives with its humidity very much reduced, having to a large extent lost it on the mountain ranges and the plateaus nearer the sea. The climate is consequently drier, as is seen from the steppe-like and indeed desert landscape prevailing in that area, except in the irrigated districts where the vegetation flourishes and one comes upon oases rich in cereals and fruits.

Politically, the Karakoram Range is part of Kashmir, a territory disputed between India and Pakistan, of which latter country it forms the extreme northern area, marching with Russian and Chinese Turkestan. At the present moment the armistice line, on which armies of the two nations are stationed, cuts Kashmir in two, so that the western Karakoram is reached by routes in territory occupied by Pakistan, the eastern by those in territory occupied by India. K2 (28,250 feet), the second highest mountain in the world, rises at the end of the Baltoro glacier and is in the western Karakoram; it is approached through Pakistan from Skardu, the last inhabited centre towards the north which can be reached by mechanical transport.

It would seem that the Karakoram Range was visited for the first time by

Europeans in 1715 (Padre Ippolito Desideri da Pistoia) but its geographical exploration only began during the nineteenth and twentieth centuries. It would take too long to enumerate here the names of the pioneers, among whom there were some Italians. In the territory we visited, the expeditions of Godwin-Austen, the Duke of the Abruzzi, the Duke of Spoleto and Eric Shipton (all before the last war) are especially memorable. During the last half-century, K2 has been attempted five times by climbers of different nationalities. The first attempt was in 1902 by the International Expedition of Ekenstein-Pfannl-Guillarmod; the second was that of the Duke of the Abruzzi which, during 1909, opened the way along the South-East Ridge, then called "Abruzzi Ridge." The other attacks were delivered by United States mountaineers led by C. Houston (1938–53) and by Wiessner (1939). These expeditions were able to reach the "shoulder" of the giant, and Wiessner climbed to the height of about 27,500 feet. Five climbers lost their lives in the course of these attempts, two of them Americans.

The Government of Pakistan had, in the middle of July 1953, granted me permission for the preliminary journey. Within the space of ten days I had to organize and forward the luggage by a ship sailing once a month from Genoa to Pakistan. For the mountaineering part of the expedition, I secured the help of Riccardo Cassin, whose expenses were covered by the Italian Alpine Club. On August 20, I left Italy by air for Karachi, whence I proceeded to Rawalpindi, where I met the Houston Expedition on its return from K2, and thence by air to Skardu, the starting point of the caravan route for the Karakoram Range.

Before proceeding towards K2 I visited, on the invitation of the representative of the Pakistan Government, the valley of the Stak, an affluent on the right bank of the middle Indus, to study the problem of a glacier which, during the previous spring, had advanced about 8 miles in the course of three months, and had covered the whole valley, seriously threatening the underlying villages. Thence, over two passes more than 13,500 feet high, I reached the main route to K2, arriving at Askole, the last inhabited village, 9700 feet high, on September 18. I then proceeded to the Baltoro glacier and its chief tributary, the Godwin–Austen, reaching the slopes of K2 at about 15,300 feet on September 26. After carrying out a reconnaissance under the Abruzzi spur, I returned to Skardu, and four days later reached Rawalpindi, returning to Italy two months after my departure. On my return I learned that the Pakistan Government had granted me my permit for a full-scale expedition, and only from that moment could I set seriously to work to secure the necessary financial backing.

The Preparatory Phase:—The basic plan, which I drafted immediately after my return, provided for two parties, a mountaineering and a scientific group, the former to undertake the ascent of K2, the latter the task of completing and extending the research carried out by earlier expeditions, and particularly by the Italian expedition of 1929. The plan met with some lack of enthusiasm in mountaineering circles, where it was believed that scientific activities might seriously handicap climbing. But I did not give up because I believed that a dual success might be achieved by careful preparation and a proper distribution of the tasks of the two parties in time and place, realizing at the same time a considerable reduction in the expense which two separate expeditions would have involved. Nor could we have been sure of permission to send two expeditions in different years.

My financial plans were based on two important grants which I expected, one from the National Research Council and one from the National Olympic Committee. The remaining sum was raised by subscription by the Italian Alpine Club.

The Club in fact appointed one *ad hoc* committee of leading members to cooperate in the mountaineering part of the undertaking; when, owing to bureaucratic difficulties, the contribution of the Research Council had to be temporarily suspended, the Committee, chiefly through the Vice-President Dr. Vittorio Lombardi, intervened to organize the financial side of the enterprise.

I shall only record here the general time-table of the expedition, with reference to the mountaineering programme; detailed time-tables existed for each of the four phases but, for reasons of brevity, I shall not go into them.

1st Phase: Preparations for the Expedition carried out in Italy from 25 November 1953 to 31 March 1954.

2nd Phase: Transportation of the members of the expedition and baggage from Italy to the Base Camp. Acclimatization and training. General test of the materials on the spot. From April 1 to June 15.

3rd Phase: Attack. Fitting out the camps of the Abruzzi spur of K2. Transfer of supplies to the higher camps. Final attack. From June 10 to July 20.

4th Phase: Return journey. The return to Italy of the mountaineers from July 21 to August 16.

With regard to the scientific activities of the Expedition, all the operations as far as Skardu had been arranged to conform with the above time-table. From Skardu the scientists, provided with light caravans, were to carry out their work independently, first in the Stak area and then on the Baltoro, where a meeting had been arranged for July 20. Their return to Italy had been settled for the first half of October.

The preparations set forth in the basic plan were carried out, almost without exception, at the given dates. Only the attack on the summit of K2 was delayed owing to exceptionally and protracted bad weather. I must also say something about the technical and organizational ideas applied to the attack on K2, for these represent important elements in our success. They were:

(*a*) The "heavy" structure of the Expedition, *i.e.* its organization so as to make it possible to remain for a considerable length of time at high levels.

(*b*) Complete equipment with pitons and fixed ropes along the whole route of the ascent, from the base on the Abruzzi spur to the "shoulder" and beyond. We had, in fact, nearly 3 miles of rope with us.

(*c*) Organization of all the camps which were provided permanently with all necessities for the mountaineers according to our pre-arranged plan.

(*d*) A higher camp was only occupied when the preceding one had been adequately equipped and provisioned.

(*e*) Transfer of the loads on the Abruzzi spur by means of windlasses and telepherics whenever possible.

These measures aimed above all at safeguarding the lives of the men and limiting physical and psychological strain as much as possible. For this, a comfortable base camp and ample supplies of food and equipment were necessary.

The staff [1] of the Expedition was to have consisted originally of eight moun-

[1] In addition to myself as leader, there were: Professor Paolo Graziosi, 47, professor of ethnography in the University of Florence, ethnographer; Professor Antonio Marussi, 46, professor of geophysics in the University of Trieste, geophysicist; Dr. Bruno Zanettin, 31, professor of petrology at the University of Padua, petrologist; Captain Francesco Lombardi, 36, geodetical expert and topographer at the Italian Military Geographical Institute, topographer; Dr. Guido Pagani, 37, assistant at the Civil Hospital of Piacenza, medical officer.

The mountaineers were: Erich Abram, 32, of Bolzano; Ugo Angelino, 32, of Biella; Walter Bonatti, 24, of Monza; Achille Compagnoni, 40, of Cervinia; Cirillo Floreanini, 30, of Cave

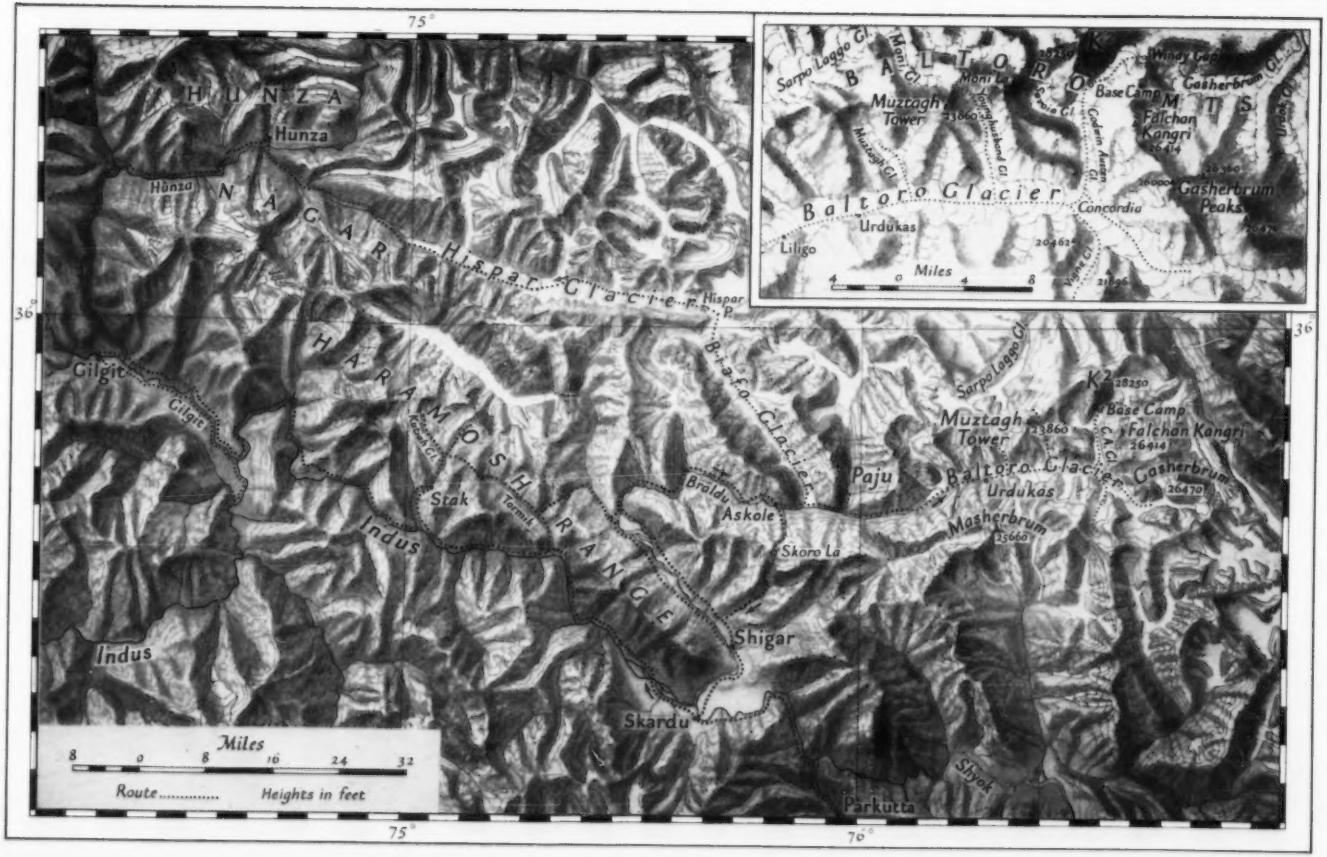
taineers and six scientists plus the leader, while two more mountaineers were to have been added if it proved possible to dispose of at least four Sherpas. Actually the mountaineers were increased to eleven, while the scientists were reduced to five.

On the basis of a first general examination, twenty-three men were chosen who seemed the best suited for the work. I summoned them to Milan on December 15 and told them the conditions and requirements of the Expedition. They were all volunteers and therefore received no pay. After this meeting, when I illustrated the climbing problems of the Abruzzi spur of K2 with colour slides, the first medical examination and physiological tests of the candidates were held in the clinics of the Milan University. A first selection was made on the basis of this test.

As none of the candidates had taken part in mountaineering expeditions except in the Alps, and in order to test some of our equipment, I had arranged two winter camps for the candidates at high level, one of them under the Piccolo Cervino at the height of about 11,600 feet, and the other on the Monte Rosa group between the Gnifetti refuge hut and the summit (15,216 feet). During our stay in camp, I arranged for climbing and glacier exercises under the control of an officer of the Alpine Military School. The first camping period took place during the second half of January. Before leaving, the mountaineers were subjected to further physiological tests and examinations at the Turin University Institute and the tests were repeated at a height of 12,000 feet at the end of the exercises. On the basis of the physiological tests and the report of the military observer, the Committee made the final selection of the mountaineers. Their number was increased from eight to eleven because I had been informed that it would be practically impossible to recruit Sherpas.

During the two camping periods, tests of equipment were carried out and studied by special sub-committees of scientists and technical experts in various branches of industry. The tents, for instance, were specially made on the lines of those used by the Swiss and the British on Everest. The first model had been used during the preparatory Expedition of 1953 and after that experiment it had been improved on the basis of the experiences of the camp on the Piccolo Cervino, where the temperature had always remained very low (a minimum of —27° C.). For the inner lining of the tents, several different materials were used, such as cotton, wool, silk and nylon. In these experimental tests, thermometers were installed and temperatures inside and outside were compared; ropes, portable receiving and transmitting radio sets, a light telepheric, various garments of wool, cotton, etc., were tested. The last test was carried out in the Monte Rosa camp. The open circuit oxygen respirators, of which two types were adopted (one Italian especially manufactured for us and one of foreign manufacture), required particular study by the special sub-committee. Provisions were selected by a committee of manufacturers, mountaineers and physiologists; the boots were prepared by a committee of technical experts, improving the British type with opossum lining for the approach and using the Swiss type of reindeer skin for higher levels. A liquid gas called propanum was chosen for cooking fuel, in containers which could be used as ovens and lamps. It was tested in a decompression chamber. The equipment was stocked in the underground vaults of the Geological Institute of Milan University, which was the headquarters of the Expedition, and was ready to be shipped by the middle

del Predil; Pino Gallotti, engineer, 36, of Milan; Lino Lacedelli, 29, of Cortina d'Ampezzo; Mario Puchoz, 36, of Courmayeur; Ubaldo Ray, 31, of Courmayeur; Gino Soldà, 47, of Recoaro; Sergio Viotto, 26, of Courmayeur; Mario Fantin, accountant, 33, of Bologna, cameraman.


75°
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Hispar Glacier
Hispar P.
HARAMOSH RANGE
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Gilgit R.
Stak
Tormik
Indus
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Braldu Glacier
Braldu R.
Askole
Skoro La
Shigar
Skardu
Paju
Baltoro Glacier
Urdukas
Masherbrum
25660
Sarpo Laggo Gl.
K2
28250
Base Camp
Muztagh Tower
23860
Falchan Kangri
26414
Gasherbrum
26470
Shyok
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BALTORO
Sarpo Laggo Gl.
Mani Gl.
Mani La
Muztagh Gl.
Muztagh Tower
23860
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Biafo Gl.
Base Camp
Falchan Kangri
26414
Gasherbrum
Urdok Gl.
Urdok Gl.
Gasherbrum Peaks
Baltoro Glacier
Concordia
Urdukas
Liligo
20462
Miles
4 0 4 8

K2 from the Base Camp: Leader in foreground

Summit of K2 with flags of Italy and Pakistan

of March. The cases were packed by members of the Expedition and their friends—a laborious job, as I had arranged that the cases were for the most part to reach their destination without being opened at Skardu or at the Base Camp. They were thus numbered in black, red, green or blue according to contents and destination. We also had different types of packing material: canvas bags, small cases of plywood, and boxes of waxed cardboard with special internal insulating material. Italian industries, technical experts and skilled workers did all in their power to help us in this crucial preparatory phase.

The ascent of K2:—I left Rome by air on 13 April 1954, and the main party joined me at Karachi a week later. Thanks to the customs facilities accorded us by the Pakistan Government and the generous collaboration of friends in Karachi, our heavy luggage, arriving on a vessel of the Lloyd Triestino on April 13, was forwarded at once to Rawalpindi. Here the meteorological conditions, unfavourable for the flight to Skardu, held us up for several days. During this period, we were joined by Colonel Ata Ullah, of the Pakistan Medical Service, as Government observer, by three Pakistan officers (Major Beshir, Captain Butt and the engineer officer Munir) to assist us in the organization of transport as far as the Base Camp, and by the assistant topographer Bashadjan. Finally, on April 27, the weather having improved, it became possible to transport by air all the luggage and part of the Expedition to the Skardu oasis on the left bank of the Indus.

While we were organizing this great caravan for the transport of the 500 loads to the Base Camp with the help of the local authorities and above all of Ata Ullah, we made a first flight round K2 with the same plane and the same crew which had conveyed us thus far. In a clear sky and limpid atmosphere the aircraft took off from the emergency landing ground at Skardu at 6.30 a.m. on April 30, and rose by broad spirals over the vast sandy plain where the waters of the Shigar join the Indus. On reaching 21,000 feet, we flew towards the village of Askole and the great mass of the Baltoro Glacier, reaching Concordia where the two principal branches join. After attaining our highest ceiling of 22,500 feet, we turned towards K2 which rose up on our left. The conditions of the mountain, especially towards the summit, did not appear to me different from those reproduced in the photographs which Houston had kindly given me. Soon afterwards we passed over the Windy Gap and reached the great Gasherbrum and Urdok glaciers, barring the Shaksgam valley, of which I had made a topographic survey during the 1929 expedition. This experience of twenty-five years ago proved very useful as it enabled me to find my bearings and to direct the route amid the complicated network of valleys, crests and glaciers of that impenetrable land. On reaching the Shaksgam valley, we diverged towards the Sarpo Laggo glacier, already well known to me, and on reaching the level of the characteristic Muztagh tower, it was fairly easy to find the pass of the same name and to return to the Baltoro and thence to Skardu, after a two-hour flight. This aerial view of the territory to be explored had supplied me with data on the snow conditions of the Baltoro, which appeared covered with snow only above 13,000 feet.

Meanwhile we recruited 500 coolies in the environs of Skardu. These, for supply and transport reasons, I subdivided into three groups under the command of Solda, Compagnoni and Angelino respectively, assisted by the Pakistan officers and the head caravan-man Sadiq, and by ten Hunza porters, especially recruited by Ata Ullah to help in transport at high levels. The three groups left Skardu between April 30 and May 2. I left with the last, but, speeding up my march, I gradually got ahead so as to see personally how the caravan was proceeding. At Askole Ata

Ullah had in the meantime found the large supplies of flour necessary for proceeding through uninhabited territory. Coolies consume nearly 2 lb. per head each day, so that our daily requirements amounted to half a ton. There were days in which my marching caravan on the Baltoro totalled nearly 700 men. In addition to these, three more small caravans, sometimes independent of each other, sometimes united, operated in the Stak area with the scientists.

It is easy to imagine what problems of supply and transport occupied my mind during those days, and how anxious I felt when, on reaching the Liligo halting-place on the left side of the Baltoro on May 9, it began to snow. The Baltis had no winter clothing, nor could I provide it for such a large number. On the following day the march on the glacier took place under a heavy snowfall and in an icy temperature. Luckily, at Urdukas, there were good natural shelters and fuel. But as the snow showed no sign of stopping, the coolies refused to proceed further. Every day's delay created new transport complications, owing to the dwindling supply of flour; on the other hand it was impossible to go ahead with so many men in such a snow storm. The first desertions began, fortunately not very numerous. In the early afternoon of the following day, leaving most of the mountaineers at Urdukas for the first period of acclimatization and training, I was able, when the weather cleared up a bit, to get the caravan going again. The snow increased on the ground as we marched and this made progress laborious. On the morning of May 13, after two icy nights, the wind cleared away the clouds and the sun came out to warm us up; but at the same time the blinding glare of the snow created further difficulties. We had snow-glasses, but not enough for such a large number of men since, during our previous flight over the Baltoro, all this area had been clear of snow. On the morning of the 14th, the situation became critical as the Baltis seemed determined to leave us. After long negotiations, however, we induced most of them to carry on though some bolted, simply dropping their loads along the track.

In the afternoon we reached Concordia, the magnificent mountain amphitheatre at the confluence of the two great arms feeding the Baltoro. K2 rose majestically in the background of the Godwin–Austen glacier. Nearer to us rose another 24,000-foot peak, the Falchan Kangri (Broad Peak), and the Gasherbrum with two more 24,000-foot peaks, to a large extent hidden from view by their younger brother. The spectacle was magnificent, but it was a wintry landscape.

On reaching the halting-place, at 14,000 feet and at only five hours from the Base Camp, the worst happened. All the Baltis, exhausted and burnt by the sun, laid down their loads, raised vigorous protests and set forth in small groups on the way back. Compagnoni, Gallotti, Ata Ullah, the three Pakistan officers, eight Hunzas and only one Balti, besides the caravan head man, remained with me. I was at my wits' end, impotent to restrain this mass of disgruntled men. I at once sent the Pakistan officers and the caravan head man back to Askole to recruit as many coolies as possible.

On May 15, on a bright sunny day with a limpid atmosphere, I re-ascended the glacier to the foot of K2 to choose a site for the Base Camp; the general plan for the expedition provided for the formation of the Base Camp by that date. On that occasion I only set up one tent as a gesture. The weather broke once more and it began to snow obstinately; in two days the snow stratum had risen to 2 feet. Finally, on May 19, a caravan of fifty Baltis, led by the mountaineers who were at Urdukas, unexpectedly arrived, and the next day we pushed ahead with Compagnoni, Puchoz, Gallotti and Rey towards the Base Camp. On their return, however, the fury of the weather not only prevented us from sending back the

caravan to the Base Camp with further supplies but put us into serious difficulties owing to the scarcity of flour. As soon as the weather cleared, it was necessary to send them back down the valley. Only on May 25 did the bad weather mend and, on the following day, by mobilizing all the available men, I myself returned to the Base Camp, remaining in touch with the Concordia Camp by wireless, but not with Skardu, with which I had never been able to establish connection.

The temperature during those days kept very low; the thermometer dropped to —20° C. The next day, I sent Compagnoni, Gallotti, Puchoz and Rey on a reconnaissance on to the Abruzzi spur. They returned the same evening and told me that they had found the sites of Camps 1 and 2 of the American expedition. During the following days, other coolies came to Concordia with Solda, carrying all the luggage left along the route, and on May 28 the other mountaineers reached the Base Camp with Ata Ullah and a caravan of 105 Baltis. The latter completed the transfer of the baggage next day to the Base Camp, while on May 30 we persuaded sixty-two of them to proceed to Camp 1, to which we conveyed most of the equipment and provisions for the assault phase. On the last day of May, all the mountaineers were finally gathered together with myself at the Base Camp, and the baggage had also arrived complete. The bad weather had delayed our general plan for fifteen days.

The reconnaissances previously carried out on the Abruzzi spur had meanwhile enabled us to identify the most hopeful tracks along the snow slope east of the spur for employing the windlass which we had brought out from Italy; this device was used to drag up our gear on a special sledge made of a pair of skis. The first experiment gave excellent results. During the following days nearly all the mountaineers, divided into two parties under Compagnoni and Solda, and a part of the Hunzas, were distributed between Camps 1 and 2 to transport the equipment by the windlasses. The weather remained favourable until June 4, and transport proceeded very speedily, but next night the sky became cloudy once more, and in the morning gusts of fog accompanied by snow involved the whole of K2. This was the beginning of a period of atmospheric disturbance lasting an exceptionally long time. In spite of the unfavourable weather, transport operations on to the Abruzzi spur proceeded, although at a slower rate. In the meanwhile, on May 29, Camp 3 had been set up, the American Camp 2 being abandoned in order to establish our own at the higher level of the sledge route. On June 14 Compagnoni carried out a reconnaissance of Camp 4, examining the conditions of the rock face dominating it which had to be overcome to reach the site of Camp 5. The "Bill Chimney," which furrows the wall, was all encrusted with ice, but we did not need the rope ladders we had brought with us. The light telepheric, already used as a windlass lower down, was a boon throughout the trip. Two days later Compagnoni, Gallotti and Puchoz again climbed to Camp 4 to carry up tents and supplies. The two latter descended to Camp 2 the same day, where Puchoz began to suffer from throat trouble, while the others returned to the Base Camp. Throughout this period the weather had remained unfavourable, with wind, snow and a low temperature. During the night of the 20th to the 21st, it snowed unceasingly, and Puchoz, at Camp 2, got suddenly worse with symptoms of pneumonia. In spite of the assistance of the doctor and the large available supplies of medicines and oxygen, he suddenly expired at one o'clock on June 21. The next day we all descended to the Base Camp, and a violent snow storm broke out.

The sudden loss of one of our team filled our hearts with deep sorrow. For three consecutive days the storm continued to rage blocking us all in our tents. On

the 26th, however, there was a slight improvement, which enabled us to recover the body and convey it to the Base Camp. On the 27th we all ascended in procession from the Base Camp to the spur at the confluence between the Godwin–Austen and Savoia glaciers. There we buried Puchoz near the monument erected the previous year by the Houston Expedition in memory of Gilkey. It was necessary to counteract immediately the depression caused by the loss of one of our team and to resume the operations on the Abruzzi Spur. Could a better way be found to honour Puchoz' memory than to conquer K2, the peak for which our friend had sacrificed himself?

The weather remained comparatively calm during the two following days. On the 28th all the mountaineers and Hunzas resumed their posts in the various camps on the Abruzzi spur and proceeded with the transport operations. But on July 1 the weather broke once more, the wind began to blow hard and the snow to fall.

Life in the tiny camps, spread out like eagle nests on the Abruzzi spur, was terrible. The continuous and violent shaking of the walls of the tents, the difficulty in cooking even very simple meals, the prolonged confinement of the men in a very narrow space, the intense cold, all this was terribly wearing to their bodies as well as to their spirits. Taking advantage of occasional short pauses in the storm, the wall above Camp 4 was scaled and the telepheric planted near its higher edge. On July 4 Compagnoni, whom I had entrusted to lead the final attack, Abram and Gallotti ascended to Camp 5, where the first tent was pitched. Two days later Abram and Gallotti climbed to Camp 6. As had been arranged, each move from a lower to a higher camp was accompanied by the placing of pitons and fixed ropes along the route, so that with the conquest of Camp 6, the whole route from Camp 1 was marked by an uninterrupted sequence of fixed nylon ropes. It was these ropes which provided security for anyone having to move along the Abruzzi spur, and which made it possible to descend rapidly to the Base Camp, even in bad weather.

We took care not to use the ropes left by the 1953 Expedition, except for two of them, coupled, just below Camp 7. On July 6, a few minutes after Floreanini had started the descent, these ropes slipped off their anchorage and Floreanini flew headlong, tumbling on a heap of snow and ending his fall 800 feet below, bruised and bleeding, but without breaking any bones. The two 1953 ropes, I need hardly say, were immediately replaced by some of our own.

The weather continued generally unsatisfactory, but nevertheless a tent was pitched at Camp 6, and on July 18 a roped party, consisting of Compagnoni and Rey, followed by Bonatti and Lacedelli, after overcoming serious climbing difficulties due to the abundant snow, finally succeeded in climbing on to the shoulder, reaching as far as the American Camp 8 and laying 700 yards of fixed ropes along the route. Meanwhile, on July 17, thanks to the help of the U.N.O. wireless operator stationed at Skardu, we succeeded for the first time in getting into touch with that station and thus with the rest of the world. The weather continued changeable. Taking advantage of the more favourable moments, Camp 6 was moved 300 feet higher up in order to eliminate the American Camp 7 (regarded by us as far too dangerous), while transport continued towards our Camp 7, first by Abram, Bonatti, Lacedelli and Gallotti, and then by Compagnoni, Floreanini and Rey and some Hunzas.

The assault on the summit:—On July 28 the weather improved considerably, and the mountaineers were able to establish Camp 8 a little below a point marked 25,492 feet under another wall of ice. There a tent was pitched for Compagnoni and Lacedelli. The decisive moment was approaching, as the weather was definitely

turning fine. The next day the two mountaineers in vain attempted to establish Camp 9; the difficulties caused by the wall of ice and the abundant snow limited their reconnaissance which was, however, repeated the next day. At the same time the four men who were at Camp 7 had set out with two oxygen respirators, a tent, and a supply of provisions for Camp 8, but only Bonatti and Gallotti succeeded in reaching it. In the course of the evening, two Hunzas, Mahdi and Isakhan, also reached Camp 7. On July 30, while Compagnoni and Lacedelli, after overcoming the ice wall, re-ascended the shoulder and went on to set up Camp 8—consisting of a very high tent, under the wall of rock which cuts the terminal cupola of K2 at about 24,000 feet—Bonatti and Gallotti descended to Camp 7 to fetch the respirators and then started off again at once with Abram and two Hunzas, with loads of supplies and propanum. After reaching Camp 8, at about noon, Bonatti and Mahdi pushed on almost at once with the respirators towards Camp 9. When night fell they were still on the march, but they succeeded in identifying the camp and calling out to their comrades. The two men higher up shouted to them to leave their loads and descend because, below them, there were some extremely dangerous slopes which could not be negotiated in the dark. But Mahdi was no longer in a fit state to go on. The two men did not dare to risk a descent, but dug a hole in the snow and passed the night in it, starting off on the return trip at dawn. Compagnoni and Lacedelli, having descended in the early hours of the morning to recover the respirators, resumed their climb.

The first serious obstacle that they had to face was the very steep channel that notches the rocky wall defending the terminal dome of K2. The direct attack seemed impossible owing to the abundant snow that filled it up. The first attempt was carried out on the rocks bordering the left side of the channel, but Compagnoni was driven back, falling down into the soft snow, fortunately without any serious consequences. The attempt was then repeated by Lacedelli. He succeeded in mounting the rocks and reached the steep overhanging slope covered with snow, where, once arrived, he made way for his companion. They were then faced by another menacing high wall, topped by jutting pinnacles, under which they had to pass. First they overcame some difficult ledges covered with very unstable snow, then leading alternately on the rope, the deep, soft snow reaching their hips, they moved laboriously to the left along the rocky crest that forms the side of the highest southern wall of the mountain. Then cloud closed in on them. They proceeded almost blindly over the encrusted rocks, until they were compelled to move again towards the central portion of the ice bank (the terminal dome itself) over ledges covered with snow, very steep and extremely dangerous. A gust of wind swept the cloud away, and they saw themselves to be near the summit. It was then that the two men felt a sudden sensation of suffocation, a strange warmth throughout their bodies and a sense of weakness in their legs. When they succeeded in overcoming this feeling, they realized that the oxygen in the respirators was finished. They at once removed their masks and deeply breathed in the icy air. Recovering, they started to climb again in a last desperate effort. Every moment it seemed as if the summit was only a few yards away, but as soon as they reached the top of the dome, another appeared in front of them. The cloud had disappeared, but a freezing wind whipped their faces. At 6 o'clock in the evening, the two climbers saw the slope gradually slip away before their eyes and the horizon open out in all directions. It was the summit, at last.

Overcome with joy, they embraced each other and hoisted the flags of Italy and Pakistan. Then they abandoned the respirators they had carried up so as to save

weight and avoid causing avalanches in the unstable snow by their movements. They remained half an hour on the top to take photographs and shoot colour films (which proved most successful).

By the time they set out on the downward march, night had already fallen, and the difficulties and dangers which they had to face proved very serious. The soft snow lying on the very steep slopes at the sides of the channel threatened any moment to slip down. The descent proved extremely risky and was carried through under the menace of "seracs" from the overhanging wall of ice. Somehow this terrible obstacle was passed and they reached the ice wall. But they could no longer see their way for it was now pitch dark; at one point Compagnoni plunged forward dropping 45 feet. Fortunately he fell into soft snow, but it was a remarkably narrow escape. At last, at 11 p.m., they caught sight of Camp 8, where their comrades and safety awaited them.

The next day the weather changed again; the wind whistled menacingly, the clouds were rapidly pursuing each other over the head of the conquered giant, while the snow began to eddy through the air. At dawn on August 1 the whole party began to descend from the shoulder, abandoning, according to instructions, everything which was not absolutely indispensable. But Compagnoni's and Lacedelli's sufferings were not yet over: after leaving the tent they were going along the steep slope covered with snow, hard put to it now to stand up but kept going by the knowledge that, with the weather worsening every minute, they had to descend as far as possible. Suddenly Compagnoni slipped. Tumbling and rebounding about 600 feet down, he would have finished on the Godwin–Austen glacier below, if a small wall of fresh snow had not stopped him. Thanks to the fixed ropes, Compagnoni reached Camp 4 at 11 a.m. There his frost-bitten fingers were treated by the Expedition doctor. Soon afterwards the others arrived, except the Hunzas who stopped at Camp 5. Lacedelli, too, had had one of the fingers of his left hand frostbitten, while Mahdi's toes had been more seriously frostbitten during the bivouac under Camp 9.

Floreanini and Rey departed the same evening of August 1 from Camp 4, and were able to announce the victory at the Base Camp. The next day, while the storm continued to rage, all the mountaineers and the Hunzas descended to the lower camps and then to the Base Camp. The mountaineering phase of the expedition had thus been successfully brought to an end.

The Expedition's scientific work:—But the Expedition as a whole was not ended, for the scientific programme had still to be completed. During the three months of the climb, the scientists—Professor Marussi, Dr. Zanettin and Captain Lombardi—had carried out, according to the pre-arranged programme, a large-scale topographical survey of the upper valley of the Stak, with particular reference to the famous Kutiah glacier; a geological and petrographic study of the whole area; and had established a series of astronomical, gravimetrical and magnetic stations, not only at key points in Pakistan, but also in the above territory. The work had then been extended to the Turmik Valley, and the geological survey to the Upper Shigar Valley. There was some difficulty in communication with the scientific party, and although Zanettin, in accordance with the general programme, reached me at the K2 Base Camp on July 17, Marussi and Lombardi did not show up till a month later when I was about to abandon the Baltoro. A week after the conquest of K2, while we were organizing the return of the climbing party and the Base Camp was being transferred to Urdukas, Zanettin and I left the K2 area to carry out a geological survey on the Upper Baltoro. Reaching Urdukas a week

later, I met the climbers on their way back, and then I went with Zanettin on to the Younghusband glacier, the largest one still unexplored of the Baltoro. I ascended this as far as its head, and went over a pass (which I named Moni-la), about 17,000 feet high, which leads to the Moni glacier, an affluent of the Sarpo Laggo, which I had already explored and surveyed in 1929. After a rapid visit to the Mustagh glacier, I descended to Askole, while Zanettin was conducting the exploration of another branch of the Baltoro, the Vigne glacier. Then I organized a light caravan to carry out a series of summary geological surveys in the basins of the Biafo and the Hispar, two of the chief glaciers of the Karakoram.

Marussi and Lombardi then reached the K2 Base Camp, where some tents, fuel and abundant supplies still remained, and carried out a topographical (photogrammetrical) survey on the great mountain, passing thence on to the Upper Baltoro, where in 1929 it had not been possible to carry out a detailed survey. I left Askole for good on August 30 to ascend the Biafo glacier, while Zanettin descended the Shigar valley by the Skoro-la, where there remained some geological problems to be studied. From there he returned to Rawalpindi via Skardu. In five days I ascended the whole Biafo, after going over the Hispar pass (16,900 feet). On September 4 I commenced a rapid descent of the glacier of the same name, leaving it on the 7th for a short stay at the first permanently inhabited village. Then, through the small States of Nagar and Hunza and along the Hunza river, I reached Gilgit on the 14th of the same month. After two and a half days of geological excursions in the neighbourhood, I returned by air to Rawalpindi, where Zanettin joined me.

During the preceding two months another scientist of the Expedition had reached Pakistan, Professor Graziosi. His task was to carry out ethnographic studies among the people of Hunza, Chitral and the Astor area, and palaeo-ethnological investigations in the Peshawar, Rawalpindi and Lahore areas. For reasons which have remained unknown, Professor Graziosi was not granted permission to carry out his ethnographical studies, but fortunately his palaeo-ethnological research achieved full success. Before returning home, I took a trip by car, chiefly for geological purposes, as far as Kabul, the capital of Afghanistan, and paid a hasty visit to Delhi to conclude an agreement for a gravimetrical link between that city and Karachi. During this period, Marussi and Lombardi, after finishing their surveys on the Baltoro, completed the geophysical programme, taking measurements in the valley of the Indus as far as Parkutta and in the Gilgit area as far as Damas (Chitral). They then established a gravimetrical connection between Karachi and Delhi and between Karachi, Beirut and Rome.

The scientific balance sheet of the expedition thus shows on its credit side a series of scientific researches in the field of geography; explorations, accompanied by topographical surveys, of vast areas of the Stak and of the Baltoro basins; the setting up of astronomical stations and the carrying out of morphological and glaciological studies in the geophysical field with numerous measurements and observations on terrestrial gravity and magnetism; and in the palaeo-ethnological field the discovery and study of various prehistoric sites. To this we should add the zoological and botanical collections, formed only at levels above 12,000 feet. The working up of the data collected and the study of the lithological and palaeo-ethnological materials brought back to Italy will require not less than three years' work. I think we may claim that the basic plan of the Expedition, in spite of the exceptionally unfavourable weather conditions, was carried out with satisfactory results. That this was possible I owe above all to the enthusiasm, the self-sacrifice

and the loyalty of my colleagues, scientists and climbers alike, and to the efforts of those earlier expeditions that opened the way along the Abruzzi ridge of K2.

DISCUSSION

Evening Meeting, 10 January 1955

Before the paper the PRESIDENT (General Sir JAMES MARSHALL-CORNWALL) said: In the name of the Fellows of the Royal Geographical Society I have great pleasure in welcoming tonight the President, two Past Presidents and the Members of the Alpine Club. This lecture is also the Dickson Asia Lecture of the Royal Geographical Society, a biennial event which we owe to a benefaction by P. L. Dickson. The title of the lecture tonight is "The Ascent of K2." I should like to insist here and now that "K2" is the correct name of the mountain about which we are going to hear; it is not Mount Godwin–Austen, as it is wrongly described in Whitaker's Almanack.

May I take this opportunity of saying how greatly I value the association between the Alpine Club and the Royal Geographical Society? It is a connection with a long history and it is testified by such names as Conway and Freshfield, Bruce and Smythe, Norton and Longstaff. It has culminated in active cooperation in the sponsoring and organization of the Everest and Kanchenjunga Expeditions. The ordinary geographer, equipped with the experience and skill of the mountaineer, is enabled to extend his researches to regions and to altitudes inaccessible by ordinary methods of travel. The mountaineer, with a close and informed study of his surroundings at those altitudes, can add greatly to the sum of human knowledge besides achieving personal prowess.

I can think of no finer example of the scientific mountaineer than our lecturer tonight. Professor Ardito Desio is not only a mountaineer of distinction—he is also a highly competent scientific geographer. He is Director of the Institute of Geology at the University of Milan, a Member of the Italian Academy and the editor of two scientific journals dealing with geography, natural history and palaeontology. In the past thirty-three years Professor Desio has led fifteen major expeditions in Albania, Persia, the Karakoram, East Africa, Libya and the Central Tibesti region of the Sahara, mainly in the pursuit of geological and mineral research. This is the first time he has described his exploits with the Italian Expedition of last year which climbed K2 for the first time in this country. The mountain is the second highest in the world and one of the most difficult to climb.

Professor Ardito Desio then read the paper

The PRESIDENT: We are privileged to have a large number of very distinguished Alpine and Himalayan climbers with us and I should like to call upon one of the Old Guard, so to speak, Dr. Tom Longstaff.

Dr. T. G. LONGSTAFF: In 1909 I travelled out in the same steamer as His Royal Highness the Duke of Abruzzi, Luigi Amedeo di Savoia. He had already climbed Mount St. Elias, explored the whole of the Ruwenzori and made a "farthest North." He tried K2, but conditions were against him; nevertheless he made an altitude record of 24,000 feet, on Bride Peak. Since then three fine expeditions have failed to make the summit. I sincerely congratulate this Italian team to whom it has fallen, forty-six years after the Duke had pioneered the route, to complete the ascent of the second highest mountain in the world.

The PRESIDENT: I now call upon the Young Guard, and ask Brigadier Sir John Hunt to make a few comments.

Sir JOHN HUNT: I am grateful for this opportunity to pay my tribute to a splendid achievement. No one listening to the story could fail to be struck by three things. The first is the thorough planning before the expedition was launched, for which Professor Desio must take the primary credit. The second is the obviously high quality of the climbing party. Those of us who have climbed in the Alps in recent years know very well that the Italian mountaineers are amongst the leading experts

in the Alps. The third thing is something which must have struck particularly all who listened to the story of the American Expedition, as related last year, namely, the sense of continuity and cooperation which resulted in the Expedition finally getting to the top. I am sure Professor Desio would be the first to admit that he must have learnt a good deal from the efforts of the American Expedition, and to recognize the part the weather plays in the Karakoram, as it did during the Everest Expedition, and how it affects your getting to the top or not.

I was one of those who were lucky enough to be invited to Italy in the autumn of 1953 to the Italian Alpine Club, and none of us who were there then will forget the generous reception we received. May I on behalf of British mountaineers and the Everest party offer to you, sir, our very sincere congratulations?

The PRESIDENT: I shall ask Sir Edwin Herbert, President of the Alpine Club, to thank our lecturer.

Sir EDWIN HERBERT: In bringing this delightful meeting to a close there are two things I should like to say about this magnificent climb. Those of us who know about the American Expedition of last year will realize that the slides we have been shown tonight do not to any great degree bring out the difficulty of the climb. The rock ridge towards the end of the climb is a very difficult proposition which Professor Desio chose to pass over tonight in discreet silence. It may be that the climbers were too busy at that stage to take photographs, but one should bear in mind that it is an exceedingly difficult mountain.

The second comment, not a wholly facetious one, is that we now know what happens when people reach such heights—they first discard their oxygen and then take photographs. I cannot believe the real mystery of oxygen and its effects is yet solved when the first instinctive action of anybody reaching such heights is to take it off.

Finally, I want to thank the President of the Royal Geographical Society and the Fellows for making this joint meeting possible. He said some very nice things about the cooperation which has taken place between the Royal Geographical Society and the Alpine Club. They are some of those nice things that happen to be true and I should like to say how entirely we agree on our side as regards the fruitfulness of this association.

THE BRITISH NORTH GREENLAND EXPEDITION

COMMANDER C. J. W. SIMPSON, D.S.C., R.N.

Her Majesty The Queen, Patron of the Society, and His Royal Highness The Duke of Edinburgh, were graciously pleased to be present at a meeting held in the Royal Festival Hall, London, on the evening of 29 *November* 1955, *at which Commander C. J. W. Simpson, D.S.C., R.N. described the work of the British North Greenland Expedition* 1952–54, *of which he was the leader.*

THE STORY which I have to tell concerns the activities of thirty young scientists and members of the Services during two years, from 1952 to 1954. There were twenty-five of us in Greenland during the first year. By half-time some of the scientists had completed their work and were relieved by others from home. Sixteen of us continued for the full two years in Greenland.

Greenland is about the size of western Europe; it is a sub-continent, or the world's biggest island, whichever way you like to look at it. Nine-tenths of it is covered by ice; Greenland is in fact a gigantic basin of ice, 9000–10,000 feet thick in some parts, the centre of the ice sheet rising to about 10,000 feet above sea level and the floor of the basin we know to be at least 600 feet below sea level in some places. The ice overflows through the broken rim and forces its way down through gaps in the mountains to the coast in a series of great glaciers. Nearly all the native inhabitants are settled on the west coast, where a warm sea current takes the chill off the climate. The north-east coast near where we were based is much less accessible; it is guarded from the sea by a belt of pack ice which may be as much as 100 miles wide, and to force a way through the east Greenland pack is difficult and dangerous, even in the specially built ship which is necessary. It is rather a sad reflection to me, being a sailor, that the Royal Navy has no ships at the moment which are capable of penetrating that ice, and there are only two British ships in all which are able to do so. Apart from these, any British Polar expedition going north or south has to charter a foreign ship.

The story of our expedition is rather a rambling one. Except during the winter we had five or six different parties in the field at once, all doing different jobs in different parts of the country, and never from start to finish were we all together under one roof. That is the nature of modern scientific expeditions. But our varying activities were joined together by a common thread: we wanted to know just what the northern half of Greenland consisted of and what was the nature of its rocks; how thick was the ice sheet, what were the climatic conditions which allowed this curious relic of the Ice Age to exist, and what has happened to the land surface beneath its crushing weight. We also wanted to know how the human body adjusts itself to such climatic conditions. Another object of the expedition was to gain experience of living and travelling in the Arctic, and to learn how best aircraft and vehicles might be used for polar exploration; experience which might be of value to the armed Services. And it was also our desire to make some further contribution to polar exploration, to that continuing adventure which, during the last two centuries or more, has played its own distinctive part in our country's traditions.

In the summer of 1950 I went as a guest of the Danish Expedition to Peary Land

in the extreme north. The Danes ran a fine show there in 1947–50 and they invited me to take part in the relief of that expedition. No ship has ever penetrated to Peary Land, which is completely isolated by pack ice, and the Danes had to ship all their stores to Young Sund on the 74th parallel. From there they organized an air lift by Catalina flying boats, 500 miles north to Peary Land. It was while I was flying north in one of these, along the edge of the Greenland ice sheet, that I first saw a mountain range which was not shown on any English map. The coast here is composed of mountains about 3000 feet high; not spectacular, but high enough to act as a barrier which holds back the inland ice from the coast. As we flew along the coast over the mountains, I could see far inland another distant range which was not on our maps. I pointed to this range, and asked the pilot: "What is that land? I have never heard of it before." He replied: "That is Dronning Louise Land—it has not been explored and nobody knows much about it." When I heard of this unexplored land, I knew I wanted to go there, and the idea of an expedition to that part of Greenland took shape in my mind (see Fig. 1).

There were two important things about the terrain to be observed from the air. First of all, to the west of the coastal mountains which lay beneath us there was a glacier 20–30 miles wide separating the "new" land from the coast. Further west still, beyond Dronning Louise Land, there was nothing but ice for 700 miles, right across Greenland to its far coast. As the ice sheet is really a gigantic glacier, it flows slowly outwards from the centre towards the coast: on the east side its flow is barred by the mountains of Dronning Louise Land which are 100 miles long. The ice is deflected by these mountains and flows round the range to north and south, forming two great glaciers which encircle the land like a pair of embracing arms. The northernmost of these is Storstrømmen, which is 20 miles or more wide and 50 miles long, and which looked from the air both undulating and broken—in fact rather like the Straits of Dover might appear if you can imagine the sea suddenly freezing solid during a fresh blow. The ice was quite bare when I first saw it, for in summer there is an intense thaw in that region for about six weeks, when the snow melts and runs off the glacier surface which is only about 800 feet above sea level. Not only is the glacier very uneven, but it is split up by countless water channels, in some cases torrents pouring down the gorges, 50 feet deep, which they have worn in the ice. It looked an exceedingly difficult proposition to get any vehicles or sledges across such an obstacle in the summer. In winter, of course, there would be snow on it, but we did not know then to what extent the snow would cover and smooth the ice hummocks which stretched, wave beyond wave, across this formidable barrier.

As the aircraft continued on its way, I spotted the second important feature of the landscape: about 15 miles off I could see a lake in the northern part of Dronning Louise Land which appeared to be unfrozen, the sunlight dancing on what looked like a water surface, and not ice. If we could rely on that lake to unfreeze every summer for an appreciable period it would perhaps be possible, given the necessary air support, to fly in an entire expedition and establish its base on the shores of the lake. This would get over at one stride all the difficult marginal zone, which is the main obstacle to getting onto the ice sheet. Most of the difficulties are within 50 miles of the margin, and when you get beyond this area the ice sheet is a fine highway and you can sledge or drive where you please.

In 1951 I obtained Admiralty permission to make a brief reconnaissance and R.A.F. Coastal Command flew four of us to Greenland by flying boat and left us on the western end of Saelsøen on the near edge of Storstrømmen. This was in

August, and we walked across Storstrømmen to have a good look at Britannia Sø, as we called the stretch of water I had spotted from the Danish aircraft in the previous year. As far as we could judge, it was suitable for landing flying boats, and was probably very deep. We penetrated beyond the lake and came to the edge of the ice sheet, and from the last mountain looked down upon that vast snow desert. We saw another glacier reaching down from the ice sheet to the lake. The bottom part of it looked difficult, but, given a good covering of snow, it seemed to offer a reasonable highway to the ice sheet beyond. Britannia Gletscher, as we called it, later became our main road and nearly every journey which we made began by going up it.

The flying boat collected us and we came back to England at the end of August. An expedition committee was formed under the chairmanship of Admiral of the Fleet Sir Algernon Willis, and we began to plan in detail. We proposed to use Young Sund as a temporary flying base, which would first be stocked by ship, and the expedition's stores would then be carried 200 miles further north to Britannia Sø by flying boats. The proposal was put to the three Service Ministries and to the Royal Society, to the R.G.S. and to the Scott Polar Research Institute and was approved. Both the Navy and the Army agreed to help us with men and stores, and the R.A.F. undertook to lift the whole expedition from Young Sund to Britannia Sø by air. The expedition was to charter a ship to take all our stores, as well as the R.A.F. stores and fuel, to Young Sund, and thereafter a squadron of Coastal Command Sunderland flying boats would arrive and start the air lift. Our "Weasels," which weighed $2\frac{1}{2}$ tons each, could not be carried in a flying boat, so we planned to send the ship further up the coast to Dove Bugt and to land the vehicles at a disused trapping hut at Danmarkshavn. It was hoped from there it would be possible to drive them across the glacier, if not in the autumn then in the following spring after the winter's snow. The Danish shipping experts said that in eight years out of ten we could expect to get a ship into Dove Bugt, but two years out of ten we should be unlucky; that meant odds of four to one in our favour and we took a chance. But we lost—the captain was forced back again and we could not reach the coast further north than Kap Rink, and at Kap Rink the Weasels were landed, 150 miles further south than we had intended and we could not drive them north until the sea had frozen.

The composition of our party was as follows:[1] there were seven principal scientists in charge of their own lines of scientific research, with twelve assistant scientists or technicians, many of whom came from the Navy and Army, and six general assistants (well described as "stout-hearts") also from the Services. Our party was made up roughly of half-and-half Service personnel and civilian scientists. You might call it the offspring of a marriage between the Services and science, with the City of London as fairy godmother at the christening. All the flying was done by the R.A.F. as part of their training programme; the Admiralty lent seven naval officers (including myself) and two petty officers on duty, and supplied much food and clothing; the Army gave similar support, supplying four officers or N.C.Os. and more stores and clothing. Each of the three Services bore the cost itself of the part it played in the expedition. On top of that we had to raise about £80,000 and most of the money came from business concerns, who helped us both with gifts in kind and in cash. We have raised and spent about £75,000 and there is very little left in the kitty now. But we shall have to raise about another £3000 somehow to enable the scientists to complete their work and publish their results.

[1] For complete list of members of the Expedition, see end of paper, p. 288.

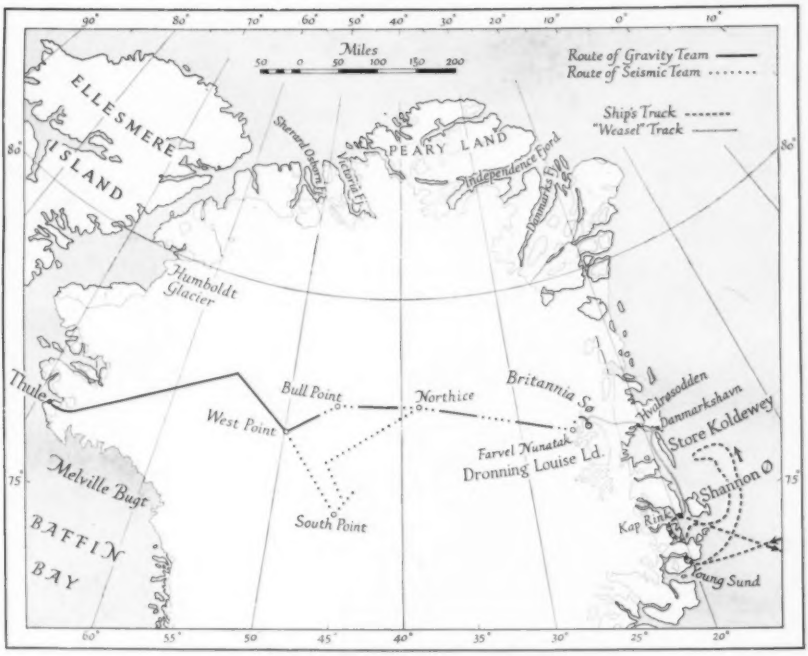


Figure 1.

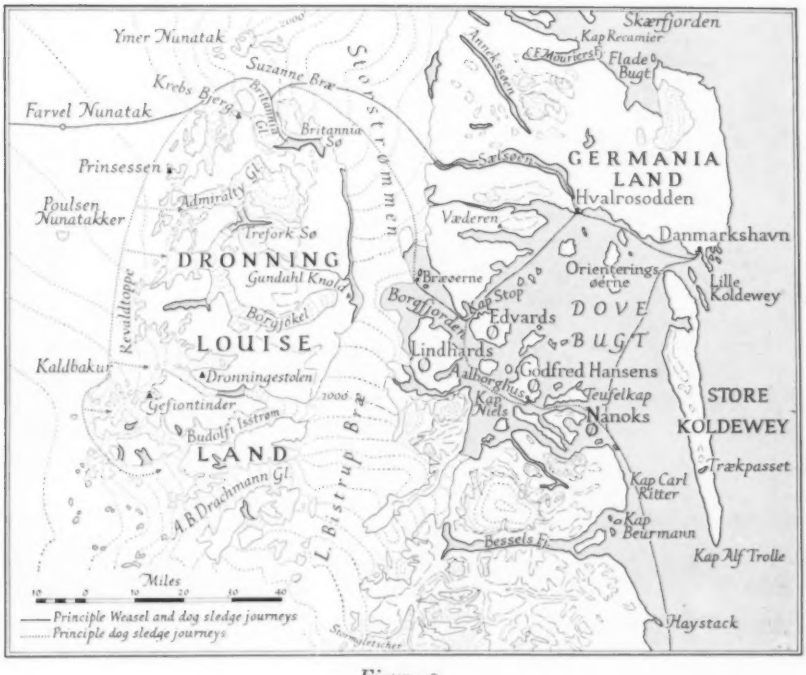


Figure 2.

Base Camp at Britannia Sø, August 1953

Sunderland flying-boat leaving Britannia Sø, August 1954

This union of the Services, science and commerce is the basic principle on which the expedition was built up. The actual scientific programme was a continuation, in some sense, of the work done by a French expedition,[1] similarly organized, in the southern part of Greenland in 1948–51. Meteorology was one of the sciences which formed part of our scientific programme. Not only is meteorological information vital to the development of flying, both Service and civilian, but, in addition, the great ice sheet of Greenland is a weather-maker, which has something to do with the climate in this country. The glaciologists were also interested in the weather, because they were studying the reason for the existence of the ice sheet itself. They wanted to draw up a balance between its rate of increase—due to snow and hoar frost collecting on the surface (mainly in winter); and the rate of decrease—due to the slow flow outwards from the centre until near the edge the lower part melts into the sea. The glaciologists, therefore, were interested alike in their own direct observations and also in the meteorological observations. They spent the first year working on a glacier near our base, and the second year at our scientific station of Northice, in the centre of the ice sheet.

The geologists wanted to study the rocks and to make a full geological reconnaissance of Dronning Louise Land, an area almost unknown from the geological point of view. We also had plans for a geodetic survey, which entailed a complete triangulation of Dronning Louise Land so as to enable a map on the scale of 1/250,000 to be produced by the Danish Geodetic Institute. The Institute had made an aerial survey of the area (oblique photographs from 4000 metres) a few years previously, and they lent us Captain J. A. Jensen to be in charge of the work. In order to connect the triangulation in Dronning Louise Land with the triangulation in the Dove Bugt area which had been made by the Danish Danmark Expedition of 1908, the latter had to be extended.

Geophysical research on the ice sheet itself, involving a gravity survey and a seismic survey, was the most important part of our programme. The forces of gravity, accurately measured, can be interpreted to tell certain things about the nature of the earth's crust below, and we planned a survey right across the country (about 800 miles from coast to coast). Before interpreting the gravity readings, we had to know the position and altitude of each station; the former was easily fixed by astro-navigational methods, but to ascertain the altitude in each case it was necessary to make a coast-to-coast theodolite survey—a very slow job and a cold one. The Gravity Team made 350 stations and the job took two years to complete. I do not think a dual survey of this accuracy right across the country had ever been made before.

Closely connected with the gravity observations was a seismic survey. A seismologist's technique is to fire a small charge of explosive on the surface of the ice sheet and measure the time interval for the sound of the explosion to travel downwards and to be reflected back to the surface from the substratum of rock, which has a different density from the ice. The Seismic and Gravity Teams were equipped with three Weasels each, and they worked mainly along a line running from Britannia Sø through Northice to Thule on the west coast (see Fig. 1).

We also had two doctors with us, doing research in human physiology, and they used us all as guinea-pigs. Finally, as we had to keep in touch with the field parties and with headquarters at home, our radio operators carried on a certain amount of propagation research in conjunction with the Admiralty.

[1] Expéditions Polaires Françaises (Missions Paul-Émile Victor): see Holtzscherer, J. J., and G. de Q. Robin, "Depth of polar ice caps," *Geogr. J.* **120** (1954) 193–202.

Air lift to Britannia Sø.—I now come to the end of July 1952, when our chartered Norwegian sealer the *Tottan* was going into the pack ice. We were very lucky that summer to start with, because the east Greenland pack can contain some of the heaviest ice in the world. The 200-mile gap between north Greenland and Spitsbergen is the only major outlet from the polar basin. In the Arctic Ocean the pack ice circulates very slowly, and may be anything up to five years old when it escapes, to be carried south along the east coast of Greenland by a cold current. The old, heavy, polar ice is added to the winter ice formed on the coast, but it is the polar ice which is particularly hazardous to ships. We got through most of the pack without much difficulty, but at one stage the ship was beset for half a day. Captain Olsen, a veteran ice skipper, extricated her, and by making a detour to the south we entered Young Sund without further difficulty. Soon the stores began to pile up on the beach, and a camp was set up for the R.A.F. air crews and ground staff, and a temporary flying base established. As soon as the Sunderlands arrived we began the air lift to the north. On Britannia Sø we met with the first serious difficulty. We had been able to spend only a short time here the previous summer on reconnaissance, and then it had been relatively calm for three days out of four, but this year we found a very different state of affairs. It was extremely blowy, and winds of gale force would get up in ten minutes or so, and produce a big sea on the lake which was about 5 miles long. All our boats had to be flown in, so they were very small. We had some rectangular aluminium pontoons floated on bladders which could be taken to pieces and loaded in the aircraft, and added to these a couple of very small dinghies of orthodox shape and some R.A.F. rubber dinghies. In addition, the R.A.F. tried to parachute a life-boat to us, which would be a great deal bigger than anything else we had. When the aircraft carrying it arrived after a 2000-mile flight from home, a strong wind had just blown up; something went wrong with the parachutes, which did not open fully, so that the life-boat came down on one end, plunged under the water and was severely damaged. Eventually, we lost the boat and very nearly some lives in the icy water when three of us capsized in our little dinghy in an attempt at salvage.

One of the first jobs at Britannia Sø was to build our base hut. The site I had chosen was a sandy cove, about 100 yards across, on the north shore of the lake, and sheltered by a bank of moraine. I had been nonplussed to find that nearly everywhere the lake was so deep that there was no possible mooring for the aircraft with a safe margin of distance from the shore. But we found this little cove, and divided ourselves into three working parties—one to build the hut and the other two to unload the aircraft. The hut had been pre-fabricated in Canada by a firm specializing in Arctic huts, and three weeks later it was almost ready. We ran wires across the roof secured to steel stakes, to keep it in place during winter blizzards. It was in two parts: one contained the main laboratory for the scientists, the radio and generators, a little office and dark-room, while the other provided the living room and a passage with six little sleeping cubicles off it, with four bunks in each cubicle. There was also a galley and a sickbay. The two parts of the hut were joined together by an aluminium vestibule, which was supposed to be fireproof, with the idea that if one part of the hut caught fire there was a chance of isolating it. A mile and a half to the west was the snout of Britannia Gletscher—our highway for all journeys to the ice sheet. Beyond lay a ridge of mountains, and then the ice sheet itself (see Fig. 2).

Air drop to Northice.—By August 20 the air lift to Britannia Sø was complete, the R.A.F. had flown home and the twenty-five of us were left alone, confronted with

the task of establishing a station on the ice sheet, as near as possible to the centre of Greenland. Northice, as we called it, was to serve both as a base for scientific research and as a petrol dump for the Weasels, and we had planned to have our provisions flown to us from Thule on the west coast in Hastings aircraft of Transport Command. Our first step was to send a dog sledge party to an agreed rendezvous on the ice sheet to receive the air drop which would supply all necessary material for stocking Northice, and also all the petrol for the Weasels which were to operate on the ice sheet in the following year. We had made a brief aerial reconnaissance before the Sunderlands left, to look at the approach to the ice sheet. Like Storstrømmen on the other side of the lake, the lower part of Britannia Gletscher was very broken and rugged and we felt that in the absence of sufficient snow cover it would be impossible to sledge heavy loads. So Coastal Command parachuted the provisions needed for the sledge journey at a point about 30 miles further inland, at a small outcrop of rock which we called Farvel Nunatak (see Fig. 2).

After rather a difficult five-day journey up the glacier, we reached the place and found most of our parachutes scattered over the snow for a distance of about 2 miles. To my relief, when we had collected nearly all the provisions we had enough food for forty-five days for men and dogs, and not till then was I certain that the journey could go forward to the rendezvous with Transport Command aircraft. Towards the end of August we started to sledge westwards from Farvel Nunatak. There were six of us—three to drive the dogs and bring the sledges home, and three to remain at the station for the winter. We sledged by day, two men to each dog team, and by night we slept three in a tent. At the end of a day's run the dogs were tired, and curled up in the snow seeming to sleep, but in fact every dog kept his weather eye open for they were yet to be fed. Sledging routine is the same everywhere: when the tent is pitched, the man who is duty cook goes inside while the others pass in to him the sleeping-bags, sheepskin mats and rations and cook's boxes. Somebody shovels snow on the skirt of the tent to keep it down and prevent it blowing away in the night, while the cook starts preparing the men's evening meal. That takes about ten minutes, and the dogs know that they have that time to wait for their evening meal. Meanwhile, the teams are tethered separately to pickets driven into the snow. You will see each dog with the snow beginning to drift over him, looking dead to the world, but he is listening intently, and when a few minutes later he hears somebody going towards the sledge he will be on his feet in an instant, jumping at the end of his trace and clamouring for the block of pemmican which is his day's ration. Huskies are very attractive dogs, apt to be savage with each other but friendly with human beings. They live a kind of Victorian family life. Each team consists of eight to twelve dogs, and each has its own king dog who maintains discipline by fighting, or offering to fight, every dog in the team two or three times a day. But the others will not stand up to him; they know he is master, and he keeps good discipline. Each team is at daggers drawn with the next, and you must not let them get mixed up or blood will flow. The pace of this sledge journey was slow, because the sledges were heavily laden, with a weight of about 100 lbs. per dog. Nor were the dogs very fit at that stage, for they suffered from the voyage and had not had enough time to recover. We lost four dogs on the journey from exhaustion, and had to stop 30 miles short of our rendezvous because they were not in a condition to go on.

The R.A.F. parachuted all the delicate stores such as scientific instruments, but most of our food and all the petrol for the vehicles and diesel fuel for the hut were

dropped "free." This technique is particularly useful in polar regions: the aircraft flies level about 50 feet above the snow, and throws out the stores without parachute. Provided the aircraft is the right height above the snow, and the speed is right, the stores come down on the snow at an angle of about 45°, bounce once, roll to a standstill, and are very little damaged. The air drop went on all the time the hut was being built, and the loads were sledged in from the dropping zone, after each drop. On the second day of the "free" dropping, the pilot of one of the aircraft had a piece of bad luck and crashed. He flew into a patch of bad visibility which caused a "white-out" and learnt a very important lesson—that over a deep snow surface the radio altimeter gives dubious readings, and it is extremely difficult to estimate height accurately. When the aircraft crashed, fortunately only three men were hurt, and they not seriously. The air crew was rescued by a United States Arctic rescue flight with ski-fitted aircraft a week later.

Winter 1952–3.—The Northice hut was built in a pit about 4 feet deep to ensure a solid snow foundation. The walls were about 4 inches thick, made of a sandwich of plywood, fibre glass and aluminium foil. Our station was established and we were able to wave goodbye to the last aircraft about the first week in October. The sun disappeared for the last time on the 25th of the month; it was not seen again until mid-February. At the end of October three of us sledged back to Britannia Sø, leaving the other three to keep vigil for the next seven months at what must surely have been the loneliest station in the world. It was twilight when we got back to base, and by the end of November we entered on six weeks of complete darkness, day and night. One of the biggest anxieties at this time was the lack of snow, for when the time came round for sledging we should need a good covering on the ground. We knew beforehand how much there would probably be in terms of so many inches of water equivalent, and were prepared for the near-desert conditions of 4–5 inches, but we did not know what that represented in terms of the amount of snow on the ground. This was a critical factor for our journeys, and as the winter went on we became more and more anxious because there was pathetically little snow on the rocks and broken glaciers we had to cross. The bottom of Britannia Gletscher was almost bare ice, for after each snowfall there were so often three or four days of blizzard that nearly all the snow was blown away, perhaps to be deposited far to the east on the pack ice. Plans depended on getting our stores up the glacier in readiness for the spring journeys, and eventually we decided to man-pack for the first mile or so. We all took a share, and by the end of winter had made a depot of $2\frac{1}{2}$ tons of rations above the worst part of the glacier.

Inside the hut it was warm and snug. The geologists were kept busy sorting and grinding the rocks which they had collected during the summer, while the two doctors were always at work on their poor "guinea-pigs." They had a series of routine tests which were carried out on all of us once a fortnight. We were woken up an hour before the usual time and, while we were only just conscious, they measured the amount of oxygen consumed. Pulse rates were checked after stepping up and down on a box for five minutes with a fully loaded rucksack. Blood tests were made, and measurements taken of the fat which most of us put on during that first winter. There were plenty of jobs to do for those who looked for them—sledges and clothing to mend, scientific notes to write and all the domestic chores made harder by the primitive and frozen conditions in which we lived. There was no necessity during the winter darkness to stop all outside jobs, for in the clear atmosphere, at a time of full moon, the starlight and moonlight reflected from the snow makes it possible to see mountains 30 miles away. Our wireless operator kept

in touch with the Admiralty and at Christmas time he dealt with about 300 telegrams. One domestic difficulty was getting water. You can melt ice or snow for this purpose, but that means using precious fuel and is a slow process—it is easier to hack through the ice on the lake and get at the water beneath, even though the ice may be 6 feet thick. We used to hack a basin 4 feet wide, using the geologist's drill to get through the remaining 3 or 4 feet, and then the water would come up through the hole and fill the basin. You have to handle the drill quickly or it freezes in when the water comes through and then you have to go to work with a pick-axe. On one occasion one of our scientists was at the bottom of a hole hacking away at the ice, when the pick suddenly went through, the hole filled up with water, and there he was at the bottom of a slippery pit 6 feet deep! We took the cooking by turns, three men going on duty for a week at a time. On Christmas Day three of the chaps volunteered to cook, and gave us an extremely good dinner, which was followed with a highly popular pantomime. The Scottish contingent kept Hogmanay in a big way, and one of them had brought his bagpipes with him.

By the beginning of February we knew that the sun was not far away; at midday we enjoyed something like full daylight, and our eyes were constantly on the hills to see whether the sun was there. Then one day the soft rosy light appeared, touching the top of the mountains—the first sunlight for three and a half months. A few days later the sun itself looked over the horizon and we all had our tails up, including the dogs! The lake was a strange sight at the end of winter: at one end was the edge of Storstrømmen, an ice cliff 200 feet high; at the other end was the Britannia Gletscher, which used to calve off icebergs which became frozen into the lake ice during the winter. During the winter as this glacier moved slowly forward, making a wrinkle in the lake ice about 20 feet high, the ice buckles and great plates of it are splintered and forced up on edge. The water flows in underneath these cracks and freezes making a kind of tunnel into which filters a beautiful blue-green light.

Spring–summer 1953.—The season for real activity had begun, and our main spring journeys may be summarized as follows (see Fig. 2): the first job for the surveyors was to find a way across Storstrømmen, which by then had a little more snow on it, and to sledge along Saelsøen to Kap Beurmann. Near Bessels Fjord they made contact with the existing Danish survey stations and made this the starting point of their own survey. It was during that journey, when Jensen and Brooke were descending a mountain, that the only fatal accident of the expedition occurred, which resulted in Hans Jensen's death. The expedition lost an able surveyor and we his messmates lost a loyal and valued friend. His companion Richard Brooke suffered a severe ordeal. From Kap Beurmann the surveyors worked their way north through the islands and back to base, and in the second year carried their survey across Storstrømmen.

The geologists sledged to the mountains in the southern part of Dronning Louise Land and spent most of the season collecting and mapping the rocks of that region, and returned after about three months' work in the field. Early in June there was not much snow on the glacier and they had difficulty in getting down onto the lake, and had to work their way carefully down the ice cliff at the snout. A ribbon of open water formed all round the lake ice, which was only connected to the glacier ice by a narrow bridge in one or two places. There was a final cliff about 8 feet high and they had to unload the sledge and pass the loads down separately, and then the dogs, and then the sledge itself. The dogs hated sledging on the lake, where the ice was often so slippery the poor beasts could not get a grip.

Now that the spring had come round it was vital to get the Weasels into operation, and this involved bringing them home across the glacier from the coast where they had been landed. It will be remembered that they had been taken to Kap Rink, some way north of Young Sund, but still 150 miles to the south and about 100 miles to the east of our base at Britannia Sø. During the previous autumn we had sent a sledge party eastwards across Storstrømmen to a small Danish station called Danmarkshavn. The Danes there, about a dozen of them, were extremely helpful and lent us sledge teams so that we could take enough drivers south to Kap Rink to make up a team of eight to drive the Weasels north. By the time they arrived in Danmarkshavn, the trailers' runners had been severely damaged by broken sea ice and we were glad to accept the invitation of the Danes to leave them on the coast for the winter. As the twilight began to increase, therefore, and before the sun reappeared, two reconnaissance parties set out by dog sledge, one south and one north, to look for the best route across Storstrømmen. We knew from the air that 40 miles to the south the tongue of the glacier was only 5 miles wide, but between this narrow bridge and the sea lay a fjord full of icebergs broken off from the glacier—a fantastic number of them, choking the 8-mile-wide fjord. Again from air reconnaissance we were able to assess the possibilities of a detour northwards where it looked as if we might be able to reach smoother ice and pass round the source of the bigger rivers which cut through the glacier. The southern party had a tough time in temperatures down to $-45°$ F. in heavy going; they reached the snout of the glacier but food was running out and they had to turn back with rather a depressing report. The northern party broke their sledge because there was so little snow and it was bumped from ice hummock to ice hummock. It proved necessary, therefore, for the Weasels to reconnoitre both approaches from the other side (see Fig. 2). They had a hard time, first man-packing eastwards across Storstrømmen—we hated this glacier and seemed to spend half our lives walking across it which meant two days' hard going each time. We picked up the Weasels from Danmarkshavn and drove along the coast on the sea ice into Borgfjorden where we threaded our way through the icebergs, in fantastic moon-like scenery sculptured entirely out of ice and snow, some of the bergs being half a mile long and up to 300 feet high. We used to climb to the top to see our way ahead and then puzzle out a route and drive forward for a quarter of a mile, after which we would have to climb another iceberg and make another reconnaissance. We got 4 or 5 miles up the fjord and found conditions worse, but we managed to reach the snout of Storstrømmen, only to find ourselves confronted by a vast ice cliff 100 feet high with no way up for the vehicles. Two men climbed it, but there were crevasses at the top and it was hopeless for the Weasels. We therefore went back on our tracks and turned north with a view to attempting to cross the glacier from Saelsøen to Suzanne Brae. We would proceed ahead of the Weasels, two of us 50 yards apart, and then return and drive forward along our footprints for a few hundred yards. Then another reconnaissance, and another slow advance—it took us five days to cover the 50 miles to base. We found the key to the situation was the very obstacles which had been so difficult in summer, namely the big river channels. Now they were full of drifted snow and wherever there was a river we had a reasonable highway; we could drive along easily for a mile or two until the river seemed to lead in the wrong direction, and then we had to leave it. Some of these channels were 30 or 40 feet deep and full to the top with snow. It was a sort of jigsaw puzzle to find our way from one river to the next, follow its bed a little way and then take to the endless ice hummocks again.

All this knocked the vehicles about a good deal and particularly the sledge trailers. At times they stuck fast and had to be extricated with two ropes. Their runners were damaged so that we had to up-end them to do repairs. It was an unpleasant "cold-finger" job trying to repair the runners in sub-zero temperatures on that glacier. Sometimes we had to use pick-axes to hack away hummocks of ice before we could go on. We were five days crossing Storstrømmen and the first Weasel reached base on Good Friday, just in time for Easter celebrations. The remaining five Weasels followed in the tracks of the vanguard shortly afterwards.

As soon as the Weasels reached base their first job was to make their way onto the ice sheet and relieve the Northice crew, with whom we had kept satisfactorily in touch by radio during the winter months. We knew from experience while sledging during the previous autumn, and from what we had seen from aircraft, that there were many big crevasses along the edge of the ice sheet for the first 50 miles or so, but we did not know how far inland they went. Dog sledges did not seem to be much in danger, because the snow-bridges covering most crevasses seemed able to bear their weight, and men on skis were all right. The dogs sometimes fell in, but their traces always supported them until they could be dragged out. But the $2\frac{1}{2}$-ton Weasels were a different matter; the only thing to do was to secure them to one another with heavy nylon ropes, with a breaking strain of about 20 tons, and to secure the drivers in their seats with aircraft safety belts. We could often spot a crevasse by the slight furrow on the surface snow, and could then prod it to see how wide it was. If it was not very wide we would take a chance and drive across fast! Sometimes, however, we did not see anything to warn us, and the first one knew about it was when the Weasel gave a lurch and the rear end dropped. The driver would then tread on the accelerator and with luck the machine would just be able to lumber forward out of danger, leaving behind a yawning hole.

The first the Seismic Team saw of Northice was the latticework tower, 30 feet high, which the meteorologist and glaciologist had built. The snow had drifted up to the roof of the hut and formed a flat dome some 100 yards across, covering the area round about, the piles of stores and the crashed Hastings. The three men came out to meet the Weasel team, and took them into the hut, down a ladder and into the dim light of a tunnel cut out of the hard-packed snow. One felt one's way, and presently the snow gave place to timber, there was a doorknob to one's hand then beyond the door a hut 15 feet square, extremely warm and built in the same way as the base hut. A passage led away from the hut to a cave for the generators and a longer passage to another cave where the meteorologist kept his hydrogen manufacturing gear and other stores. The main storeroom was the crashed aircraft, which provided an excellent workroom and store.

The Seismic Team with their Weasels took the station's winter crew back to base and left a new summer crew at Northice. They then started their seismic survey, but during the first year got very little by way of results. They tried all the tricks of the trade, but got few reliable reflections from the bed-rock beneath the ice sheet. The Gravity Team started out from base at the same time as the Seismic Team and worked slowly across the ice sheet making their stations about 2 miles apart. Their progress was cold and slow, because the work had to be so meticulously accurate. By the end of the first summer they had reached about half-way across the ice sheet, that is, 350 miles from Base. In the second year they completed their traverse and reached Thule on the west coast (see Fig. 1).

Back in Dronning Louise Land the glaciologists built a station near the top of the Britannia Gletscher. They were particularly interested, as I have already said,

in the rate at which the ice sheet grows in winter and decreases in summer. They established two stations and set up their instruments near the top of the glacier where the two of them spent most of the summer. At intervals the others walked up from Base and lent them a hand. Every evening all the field parties used to get on the air and report their positions by radio: everyone enjoyed these evening radio sessions—the scientists exchanged news and views, and I was able to find out how everyone was getting on.

By July the snow had melted off the glacier, the ice was dirty with dust blown from the land, and many glacier streams had reappeared. Sometimes the dogs were unable to cross these torrents, and we had to unload the sledge, using it as a bridge, and carry the dogs across. As the snow round the base disappeared the dwarf willows and many small Arctic flowers came out; it was a delight to find these tiny, fragile flowerets hiding amongst the rocks. The animals were more in evidence also, for although they were there all the winter they were less noticeable because they were white. The Arctic hares are often very tame and have a curious habit of standing on their hind legs as you approach, perhaps to have a closer look. When you come up with them they hop away on their hind legs looking back from time to time, absurdly like Alice's White Rabbit.

Early in August the first Sunderland landed on the lake. The R.A.F. were back again, based on Young Sund as before to bring us our second year stores. The chartered ship broke down and was ten days late, and so everything had to be done with a rush; but Coastal Command had learnt a lot the year before and everything went so smoothly that they shifted 60 tons in eight days. During the whole operation we had to ship a total of 640 tons to Young Sund, and the R.A.F. lifted 250 tons by air to Britannia Sø. The total weight of stores which we needed at base was greater than that, but the Weasels went up the coast and across Storstrømmen under their own power. The total brought by air was 250 tons, and to fly that we had to ship 350 tons of petrol. It may be relatively easy to fly stores into a country like this, once all the flying facilities have been provided, but you require a much greater weight of fuel and stores for the aircraft than the expedition stores which the aircraft are there to shift. We had bad luck on the last day when the last aircraft to take off was checked by floating bits of ice from turning into open water for the take-off. A contrary gust of wind sent it aground, and we had to improvise a collision mat which kept the water out long enough to enable the crew to pump out the water from inside. Then the fore part of the aircraft was filled with concrete which was allowed to harden before she was floated off the rocks. We were relieved when she rose clear of the water, and the R.A.F. did a very fine job in getting her home.

By the third week in August the Weasels were ready to return to Northice for the second year's air drop. Someone failed to spot a crevasse near the edge of the ice sheet and the tracks broke through. The unlucky Weasel rolled over on its side, illustrating the reason for not operating with less than three vehicles in a team if there is any danger of crevasses; it may take two Weasels to drag one out of trouble. The second summer's air drop at Northice was very successful. The aircrews and ourselves had benefited by the experience of the first summer and all went smoothly. We put the Weasels and trailers in a long line at half-mile intervals. Each driver was in radio contact with the aircraft and helped the pilot to judge his height above the snow, talking him down to about 50 feet. Instead of the fuel being dropped in "jerry cans," this time it was dropped in 45-gallon drums, about 85 per cent. full. In the first year we lost between 15 and 20 per cent., but in the second year only 2 per cent. For free dropping in this way, an aircraft at a height of 50 feet and

Pressure ridges in lake ice on Britannia So

Weasel fallen through snow bridge over a crevasse

Northice in spring 1953: crashed aircraft in foreground

Air drop at Northice: September 1953

speed of 120 knots is just right. To fly lower is dangerous for the aircraft and the drums bounce and roll and hit each other on the ground. To fly higher than this causes the drums to bury themselves on landing, with much extra work for the ground party digging them out.

After the air drop, the Seismic Team carried on with their survey between Northice and Dronning Louise Land (see Fig. 1). Our seismic operator tried many different techniques to obtain reflections while operating on the east side of the ice sheet, but without success. In the second year, operating west of Northice, interesting results came through which indicated that the ice sheet in this area was about 9000 feet thick. He found that when to the west of a certain imaginary line he always obtained reflections. The reason for this is not known with certainty; one theory is that the insulating effect of the ice sheet at its thickest part, combined with the fact that there is always heat being transmitted outwards from the earth's crust, has caused the bottom layers of ice to melt to water and slush which will not return seismic reflections.

The Gravity Team spent most of the autumn working between Dronning Louise Land and Farvel Nunatak (see Fig. 1). Both Weasel teams began at this stage to have many more mechanical breakdowns and the vehicles gave us much trouble. They had had a good deal of punishment in the first year, particularly when crossing Storstrømmen, and now in the second autumn the breakdown rate was much increased. Suspension parts used to break, and it seemed that at low temperatures the actual metal became weaker; the wear and tear generally was worse, partly because efficient lubrication was more difficult. To get through our programme we were forced to work rather late in the season, after the final setting of the sun, and the low temperatures in October undoubtedly contributed to our mechanical difficulties. Towards the end of October, when the Gravity Team had finished the season's work and was going back to base, our worst accident occurred. The sun had set and, as all skiers know, it is extremely hard to judge the angle of the slope or the texture of the snow in diffused light. In such a tricky state of affairs the team found it difficult to know whether there was a crevasse ahead or not. The Weasels were roped together as usual; the leading one was towing two trailers, and the rear one towing the third Weasel which had broken down. Suddenly the two men in the rear Weasel saw the ground open and in an instant the leading Weasel disappeared followed by its two trailers, swallowed by the ice sheet before their horrified eyes. The second Weasel was jerked forward violently as the nylon rope sprang taut, in spite of the brakes being hard on. The crew got out, went very carefully forward, and looked down a gaping hole 20 feet across, with the Weasel jammed about 40 feet down and the trailers piled on top. It seemed a miracle, not only that the two men inside had escaped serious injury in the initial fall, but also that they were not killed when the two trailers with about a ton of stores fell on top of them. Two ration boxes, each weighing 50 lbs., smashed right through the Weasel and out through the windscreen, touching no one. The team had two very unpleasant days under near blizzard conditions, but they succeeded in salvaging most of the stores and both trailers—the Weasel was lost, of course. In the first week of November the Seismic Team had similar trouble. They ran into an area thick with crevasses and lost a trailer, the Weasel just managing to get across. I was extremely glad when on November 10 we got safely back to base, for I felt that we had been operating too late in the year in our anxiety to finish the job.

Winter 1953–4.—The second winter passed much like the first. Once a month the B.B.C. gave a special broadcast for us, sending recorded messages from our

friends and relations, which were most warmly appreciated. After the sledging season had started these messages were relayed to the men in the field by our own transmitter at base, sometimes as far away as the middle of the ice sheet. In the second winter there was much more snow than in the first, and this made life easier for everybody, but it brought its own troubles. The Weasels had to be dug out of snowdrifts, and the tiny garage in which we repaired them was under 6 feet of snow. It would take only one Weasel at a time, and so the trailers had to be repaired in the open—a very cold job in February and March.

When the sledging season returned the surveyors went back to the coast to take a second series of observations across Storstrømmen, where they experienced abnormal refraction. On the fjord they ran into a family of polar bears. They saw the female and two nearly full-grown cubs and knew that the father would not be far away. Later the male appeared and was chased and held at bay by two or three of the dogs until the men could catch up and shoot him. The fresh meat was exceedingly welcome for the dogs, and the men themselves were not inclined to scoff at bear steaks!

As the summer approached conditions on the ice sheet became easier, particularly for the meteorologist who had a patent machine for making hydrogen. We referred to this infernal device as the "hydrogen bomb." It was designed to work under high pressure in a temperate climate, and in theory it was simple: you put in two different chemicals and added water and chemical action took place, pressure was built up and the hydrogen filled a cylinder at about 2000 lb. per square inch. In the cold north it did not work quite like that. You put in the chemicals, added water and nothing happened. You put in warm water, and nothing happened. Then you put in really hot water and something happened rather suddenly. It was not uncommon to hear a shout and see the meteorologist running down the tunnel calling out to everybody to put out their pipes because the tunnel was full of hydrogen. The chemical action had become so violent he could not get the stopper in!

During the winter and spring a pit was dug at Northice 50 feet deep in the snow. The snow in summer does not look the same as in winter, so that by digging a pit and measuring the strata it is possible to measure the age of the snow, just as you can tell the age of a tree by the growth rings. At the bottom of their pit, the glaciologists got back to the snow which fell in the year 1877.

Spring and summer 1954.—The Weasels continued to give trouble all spring. We had done all we could, with our very small facilities, to repair them during the winter, but both teams, out on the ice sheet and far from base, had a lot of trouble. One the of Gravity Team vehicles broke down and as the Seismic Team only had the essential spare part, they carried on temporarily with only one. After that the Seismic Team found that the springs were breaking due to fatigue and the weakness of the metal at low temperatures—a temperature of $-40°$ to $-50°$ F. was about the limit for outdoor work. The mechanics had an unpleasant job in keeping their vehicles going under these conditions, and I would say that if there are any heroes of the modern type of expedition, they are the mechanics. One evening on the ice sheet, at the end of a day's work, the Seismic Team's mechanic was just starting his Weasel; when he pressed the starter button an odd noise came from the engine, there was a violent explosion, the cab blew off and the machine burst into flames. There were nearly 30 gallons of petrol on board and the tank had split, but fortunately the mechanic was not seriously hurt. That was the end of another Weasel, and both teams now had only two each, which was one too few. I was concerned

about their condition, particularly as we relied on the two seismic Weasels to evacuate the Northice crews to base, some being as far as 400 miles away. They kept going until they reached the edge of the ice sheet, where one broke down 12 miles from home; the second staggered to the edge of the ice sheet and then broke a track only 2 miles from home. The Gravity Team had similar experiences and their two Weasels also only just succeeded in getting the team off the ice sheet.

The scientists, when they got back, had up to two years' work in front of them, but what they have told me so far is roughly this: the Greenland ice sheet has been in existence for at least 400 centuries. Along the 78th parallel, the ice sheet rises to a maximum altitude of 8500 feet at long. 44° W. There the ice thickness is approximately 9100 feet, so that the bottom is well below sea level. In the central part of the ice sheet, between long. 36° and long. 52°, there do not appear to be any local features greater in altitude than 300 feet above the local level of the bed-rock. Nearer the east side, between long. 28° and 30° W., there are two ranges of hills or mountains running north and south, rising to 1000 feet or so above the general land level, and the ice sheet over them is about 1800 feet thick. It was over those buried ranges that we found so many crevasses. I have already mentioned that by digging a pit at Northice they got back to 1877 with the snow strata at a depth of 50 feet. The average annual accumulation then was equivalent to 5 ins. of rain and this did not vary much until the 1920's; thereafter it decreased, so that by 1940 it was little more than 2 inches. Since then it has increased, until it is about 4 inches today. Greenland is virtually an Arctic desert. The length of Britannia Gletscher by the end of the summer, had been reduced by about 50 yards, due to icebergs breaking off, and its upper surface was lowered by 7 feet by melting. That glacier is definitely getting smaller.

This brings me to the end of the story. In the summer of 1954, flying boats landed again on the lake and picked us up with our stores and scientific records. We could not afford to bring out much more. The whole party was once more airborne and bound for home. As we flew back to our homes and families, which some of us had not seen for two years, we were conscious—some of us, at any rate—that we were leaving behind part of ourselves in Greenland. My final thoughts on leaving the country were a curious mixture of sadness and relief. Perhaps somebody, some day, will take up the trail again and live at Britannia Sø. I hope that they do, because they will certainly never regret the experience.

LIST OF MEMBERS

1st Year only

Captain J. S. Agar, Royal Signals.—*Radio Officer.*
A.Q.M.S. S. P. Boardman.—*Vehicle Mechanic.*
Mr. G. F. Cadd.—*Seismologist.*
Mr. R. A. Hamilton, M.A.—*2nd in Command, Chief Scientist (Meteorologist).*
Dr. H. Ellis Lewis.—*Physiologist.*
Mr. J. D. Peacock.—*Geologist.*
Dr. C. G. M. Slesser.—*Physicist.*
Captain J. D. Walker, Royal Engineers.—*General Duties (Weasel Team Leader).*
Kapt. H. A. Jensen.—*Senior Surveyor.*

2nd Year only

Mr. K. C. Arnold.—*Surveyor.*
Mr. R. J. M. Bruce.—*Seismologist.*
Captain G. R. Fletcher, Royal Engineers.—*General Duties.*
W.O. II. D. Homard, R.E.M.E—*Vehicle mechanic.*
Mr. S. Paterson.—*Physicist.*

Both Years

Captain M. E. B. Banks, Royal Marines.—*General Duties (Weasel Team Leader).*
Instr. Lieut.-Cdr. R. Brett-Knowles, R.N.—*Radio Officer.*
Lieutenant F. R. Brooke, R.N.—*Surveyor.*
Dr. C. B. B. Bull, B.SC., PH.D.—*Geophysicist.*
Chief Petty Officer H. R. Dean, R.N.—*Radio Operator.*
Lieutenant A. B. Erskine, R.N.—*General Duties (i/c Sledge Dogs).*
Chief Officer E. O. Jones, M.N.—*General Duties (Weasel Team Leader).*
Mr. H. Lister.—*Senior Glaciologist.*
Surgeon-Lieut. J. P. Masterton, R.N.—*Medical Officer.*
Chief Officer R. W. Moreton, M.N.—*General Duties (Stores Officer).*
Staff-Sergeant J. W. Oakley, R.E.M.E.—*Vehicle Mechanic.*
Instr. Lieutenant G. Rollitt, R.N.—*2nd in Command (Meteorologist).*
Commander C. J. W. Simpson, D.S.C., R.N.—*Expedition Leader.*
Petty Officer Tel. K. E. Taylor, R.N.—*Radio Operator.*
Mr. P. F. Taylor.—*Assistant Glaciologist.*
Mr. P. Wyllie.—*Geologist.*

INTRODUCTION

Evening Meeting, 29 November 1954

Before the paper the PRESIDENT (General Sir JAMES MARSHALL-CORNWALL) said: May it please Your Majesty—as President of the Royal Geographical Society it is my privilege tonight, on behalf of our Council, Fellows and Associate Members, to welcome Your Majesty, our Patron, and to voice our sentiments of heartfelt loyalty and devotion. It is a real pleasure also to welcome His Royal Highness The Duke of Edinburgh, who as Patron of last year's Mount Everest Expedition shared in our efforts, our anxieties and our ultimate achievement, and who has recently made his association with us still closer by accepting Honorary Membership of our Society. The British North Greenland Expedition, about which Commander Simpson will speak tonight, was planned and organized by the British North Greenland Committee under the gracious patronage of Your Majesty and the distinguished chairmanship of Admiral of the Fleet Sir Algernon Willis. By Your Majesty's leave I will now ask the Admiral to introduce the leader of the Expedition.

Admiral of the Fleet Sir ALGERNON WILLIS then said: May it please Your Majesty—before I introduce the lecturer perhaps a few words about the inception and the objects of the Expedition might be appropriate. Though survey and scientific research was the main object, the Expedition was also conceived to gain experience of

living and travelling in the Arctic regions; that is, experience which might be of value to the Services. But there was another and overriding object, which was to make some further contribution to polar exploration which has played a distinctive part in our nation's traditions for over two centuries. It is of particular satisfaction to me that the Royal Navy has once again taken a lead in this kind of enterprise, and I may say that this was the largest expedition to leave Great Britain for polar regions for some forty years. I cannot let this opportunity pass of referring to the help and support we have received from a variety of sources. I cannot cover them all and I will leave some of the thanks to Commander Simpson, who will express them for himself and the Committee.

Your Majesty is our Patron and the keen interest that you have shown in the fortunes of the Expedition has been a great inspiration and encouragement to us all. Sir Winston Churchill is our Vice-President, and he likewise has given us much encouragement. We are much indebted to the Danish Government for permission to explore in Greenland, and it is with great pleasure that I welcome H.E. the Danish Ambassador who is with us this evening. The Committee have received help and advice from the Royal Society, the Royal Geographical Society, the Scott Polar Research Institute, and from a number of scientific bodies, which I acknowledge with many thanks. The Government and the Services have given us splendid support and assistance in a variety of ways and we have received most generous financial support from industry, for all of which the Committee is most grateful.

And now I am authorized to announce that Your Majesty has been graciously pleased to award the Polar Medal for their work in Greenland to the Expedition's members, whom it is now my privilege and pleasure to introduce to you and, in particular, Commander Simpson, the leader.

Commander Simpson then delivered his lecture, which was illustrated by slides and a film.

AFTERMATH OF THE GREAT ASSAM EARTHQUAKE OF 1950

F. KINGDON-WARD

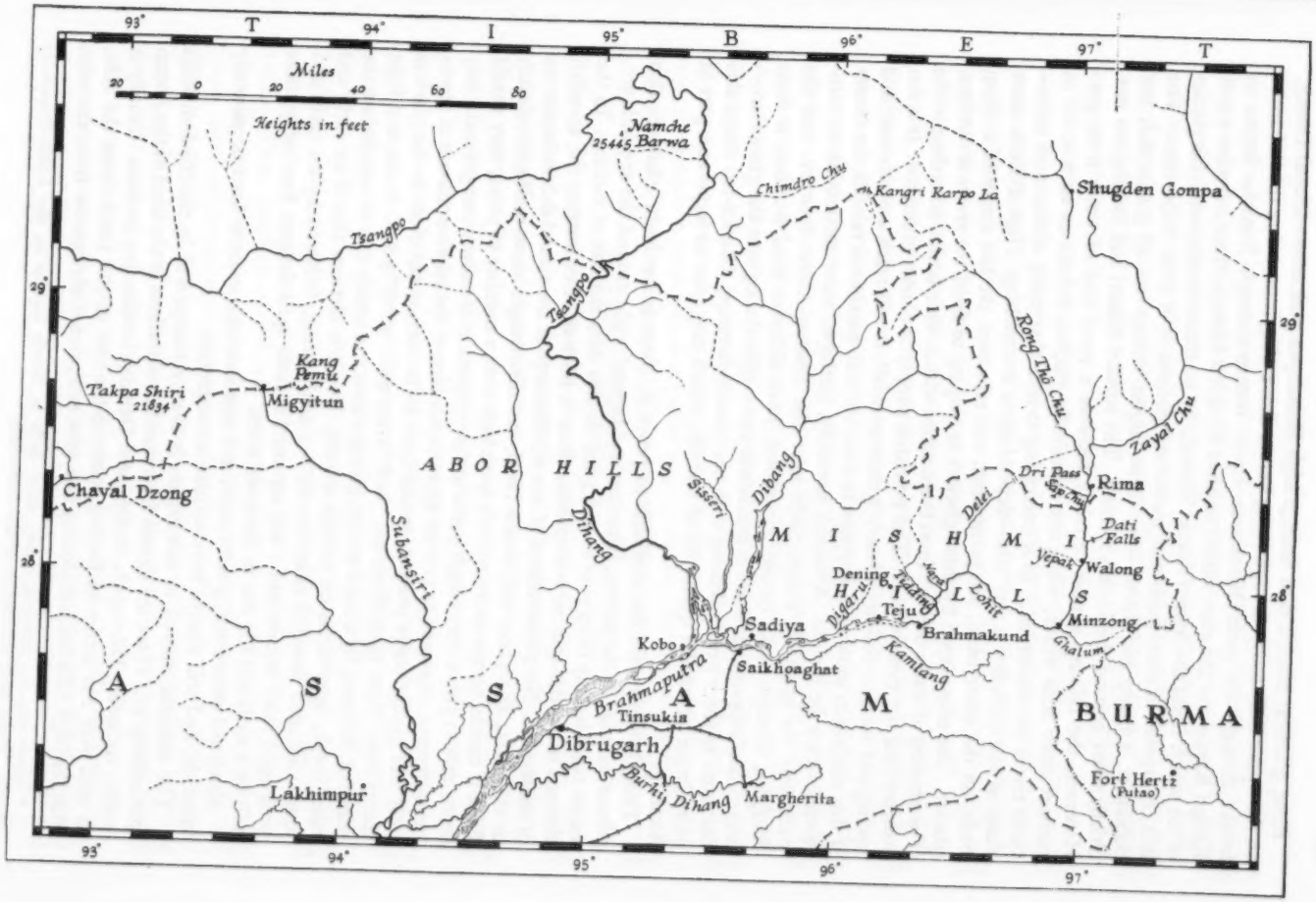
ON THE EVENING of 15 August 1950 one of the biggest earthquakes ever recorded took place in south-eastern Tibet, close to the Assam frontier (*Geogr. J.* **120** (1953) 169–82). Its epicentre was about twenty miles north-west of Rima, in the valley of the Lohit river, or rather, in the valley of its north-western branch, called the Rong Thö Chu.[1] Incalculable damage was done in the mountains, but there was little direct loss of life, either here or on the plains. Since that date the Brahmaputra has overflowed its bank every year; both Sadiya and Dibrugarh have been partly destroyed—the latter especially in 1954—and worse may happen.

Before one can indicate possible means of flood control, it is necessary to examine closely why the floods occur; and that implies not only a knowledge of the climate of this region, but also of its geography. Under the latter heading I include some knowledge of the sources and courses of the main rivers, and their chief tributaries; the topography of the country through which they flow; the types of vegetation found at all levels within the several basins; and the nature of the rocks. This is a big order, and I can do no more than outline the scope of the problem here.

As regards climate, it may be said in the most general terms that within the Indian frontier at least, the alternating monsoon seasons are the dominating factor. But whereas on the plains, and in the outer foothills, the rainy season is followed by a dry winter and spring, in the mountains there is no long dry season; both monsoons bring precipitation. On the mountains of the North-east Frontier Agency, short spells of fine weather occur in the cold weather; but these are interrupted at frequent intervals by rain—or more likely by snow—with occasional heavy storms, especially after Christmas. The Mishmi Hills region has probably the heaviest snowfall in this corner of Asia. Why this should be so is not clear, nor for our present purpose does it matter; we must accept the fact that it is so. Another peculiarity of the climate is its extreme variation from year to year, not only as regards total rainfall, but also its distribution over the months. The beginning and end of the rainy season may also vary considerably; no doubt these variations apply also to the snowfall.

In the last analysis, of course, all land-based water, whether in the form of rivers, glaciers, lakes or springs, comes from the clouds; but for our immediate enquiry it is important to know from what sources the rivers of north-eastern Assam draw their chief supplies of water, and when. We need to know how each river is likely to behave at all seasons of the year. There are three major sources of water on this frontier: (i) permanent glaciers; (ii) annual snowfall; (iii) rainfall. It is probable that the considerable areas of glaciation within the river basins conceal a number of small lakes; this is certainly true of Yunnan, for example, and to a lesser extent of North Burma. But it is unlikely that these would have any measurable effect on the flow of the rivers, whether by acting as filters, or in any other way. In what follows, the possibility of their occurrence is therefore disregarded.

[1] This river, which has its source amongst glaciers, and not the Zayul Chu, further east, may well be the principal source of the Lohit.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Miles
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Heights in feet
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Kang Pemu
Takpa Shiri 21834
Migyitun
ABOR HILLS
Chayal Dzong
Dri Pass
Rima
Sisseri
Dibang
Dihang
Subansiri
Delei
Dati Falls
Jepak
Walong
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Dening
Yigarr
Teju
Lohit
Brahmakund
Minzong
Ghalum
Kobo
Sadiya
Saikhoaghat
Kamlang
Brahmaputra
Tinsukia
Dibrugarh
Burhi Dihang
Margherita
Lakhimpur
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First, glaciers: from Takpa Shiri, a high Himalayan peak above Chayal Dzong, on the upper Subansiri, through Kang Pemu, above Migyitun, where the Subansiri breaks through the main Himalayan chain, thence through Namche Barwa to Kangri Karpo and the snow massif south of Shugden Gompa, there stretches a belt of ice which feeds the Assam rivers. Though by no means continuous, this glacier belt, composed of snow fields and numerous glaciers, is of great importance. The Subansiri, Dihang and Lohit—the three largest rivers—are all glacier-fed, but chiefly from beyond the Indian frontier. The smaller Sisseri and Dibang are not. However, the Dibang almost certainly receives a good deal of water from permanent snow beds which, while not technically glaciers, behave as such so far as these rivers are concerned.[1] It is interesting to note that many of the snow beds—those at low altitudes at any rate—depend upon avalanching. High altitude snow beds, on the other hand, are permanent, and represent the last stages of a dying glacier. The rôle played by these glaciers in helping to flood the rivers is obvious. The amount of water derived from them varies within wide limits, according to the weather and the time of year. The potential supply is almost unlimited. If a hot spring and summer follows a heavy winter snowfall, it will reach a maximum; and if this maximum snow-melt happens to coincide with maximum rainfall, the consequences may be serious. Although normally, perhaps, snow mountains so comparatively far apart as Takpa Shiri near the Bhutan–Assam frontier, and the Shugden Gompa peaks (about 275 miles), have different local weather, it must sometimes happen that there is maximum snow-melt throughout the glacier arc—the more so since we are dealing with one mountain range. Glacier-fed rivers also carry larger or smaller quantities of fine silt, which may play an important part in flooding.

Though figures are not available to prove it, there is no doubt whatever that winter snowfall in the eastern Himalaya and beyond, right around the 275-mile arc, varies considerably from year to year; and so also does the rate of melting. In the absence of on-the-spot measurements, there is no way of estimating the snowfall or snow-melt. No measurement of rate of discharge at the rivers' debouchment on to the plain, at highest and lowest flood, can disentangle snow-melt and rainfall. Even if careful temperature records were kept over a number of years, they would serve only to give a very rough guide to the proportion of snow water present. Any measurement, designed to give an approximate idea of the relative amount of snow-melt and glacier water present, would have to be carried out close to the glaciers themselves. Here again there are "bad" years and "good" years. A late and light snowfall, followed by a mild spring, giving a slow and steady rate of melt before the rains break, need cause no serious anxiety. But it is obvious that if an early and long continued snowfall coincides with a cold spring, followed by an early and prolonged rainy season and a hot summer, it must spell danger. Inevitably there will be a swift and big rise in the main river.

Abnormal snow-melt, glacier-melt, and monsoon rain must at least occasionally coincide, and will always have serious consequences.

The summer rainfall in this region is always heavy, and in the Mishmi Hills particularly so. There are figures for a number of stations at the head of the Assam valley, including Dibrugarh, Sadiya, and Dening, besides tea gardens. Usually it is well over 200 inches at Dening, close to the exit of the Lohit from the hills. But the high hills behind Dening rise with exceptional abruptness from the edge

[1] There are, for example, many snow beds in North Burma on the Lohit–Irrawaddy divide. These feed tributaries of the Irrawaddy.

of the plain, and the monsoon, compressed within the rapidly narrowing funnel-like head of the Assam valley, strikes them very suddenly. This causes exceptional downpours, as at Cherrapunjee in the Khasi Hills. However, though certain spots have excessive rainfall, it probably nowhere averages less than 120 inches, most of which falls in six or seven months, at a time when the glacier-melt is at its maximum. Thus rivers like the Dihang and Subansiri, and to a lesser extent the Lohit, are apt to flood proportionately higher in July and August, when glacier-melt and rainfall are both at their maximum, than do the Sisseri and Dibang, which carry no glacier water.

The exceptionally heavy monsoon rainfall in so mountainous a country must always be a threat, the period mid-June to mid-September being one of constant danger. Early and late periods of heavy rain are by no means unusual—especially in the Lohit and Dibang valleys; and winter rain in the Mishmi Hills (which of course means snow higher up) is far from negligible.

The proportion of water in the rivers derived from each of the three sources mentioned is important, but cannot be calculated or even estimated. Roughly the difference in discharge between winter "low" and summer "high" gives the volume attributable to rainfall plus snow-melt; the balance is permanent flow due largely to constant glacier-melt and spring water from the slowly draining hills. But no allowance has been made for the greatly increased glacier-melt during the summer, so that the figures, when extracted, are not really comparable. Moreover, there are at least two peaks—the first in the early spring, when the maximum melting of low-level snow takes place, followed by a fall, or at any rate a stationary period, before the rains break and the second, higher, peak is reached—probably in July. A heavy winter snowfall is a warning of trouble to come in the following summer; but an exceptionally heavy summer rainfall may be followed by immediate floods.

EFFECTS OF THE EARTHQUAKE ON THE RIVERS

So far I have indicated what happens in Upper Assam in any normal year. It is based on what we know of the river routine in this region, with its peculiar topography and climate. It has nothing to do with what happened during, or as a result of, the earthquake. I will now try to describe how the flow of the rivers was affected after 15 August 1950; what temporary and, more important, what permanent changes were brought about within the river basins.

The immediate result of the earthquake was to pour millions of tons of rock and sand into all the main rivers and their tributaries, within the space of a few weeks—or even days—thereby displacing millions of cubic feet of water. Nor was that all, for with the rock too often went the forest which was growing on it, thereby impeding and blocking the rivers. Much of the force of the water was taken up in moving as large an amount of this material as it could carry, out of the way; the bulk of it was dropped immediately the gradient of the river bed eased, as it left the hills. An enormous increase of silt was also carried and less quickly dropped, when the flood subsided in November. This was particularly noticeable in the Lohit valley, above and below Sadiya, where it helped to kill the vegetation, including trees, for miles along the left bank; drowning also helped. It is rare to see mud deposited hereabouts, in place of the usual sand.

Any temporary advantage which might have been gained by the slowing of the current was quickly cancelled by the sudden waves of flood water. These pulsed down the Lohit, for example, when temporary jams, either in the main valley or in large tributary valleys, gave way. I watched one such wave surging past Rima. It

originated in the Rong Thö Chu a short distance above the confluence, and in full view of Rima—and appeared to be irresistible. These waves were of frequent occurrence, often on a far greater scale. Another flood wave, also on the Lohit, though probably quite a small one, came down the Yepak a mile below Walong, making a fearful and awe-inspiring noise for several minutes. We could see nothing, as we were a mile upstream of the Yepak confluence, but we could hear everything. It might be argued that every flood wave would help to move forward the vast accumulation of sand and gravel, and so help to scour out the channel. But apart from the fact that much of the force of the wave would have been frittered away at the end of 50 miles, especially after turning the great bend at Minzong, there is another consideration: the same flood that on the upper course of the river sweeps along the sand, is strong enough as the river grows larger to move boulders and set them banging and bouncing against each other.

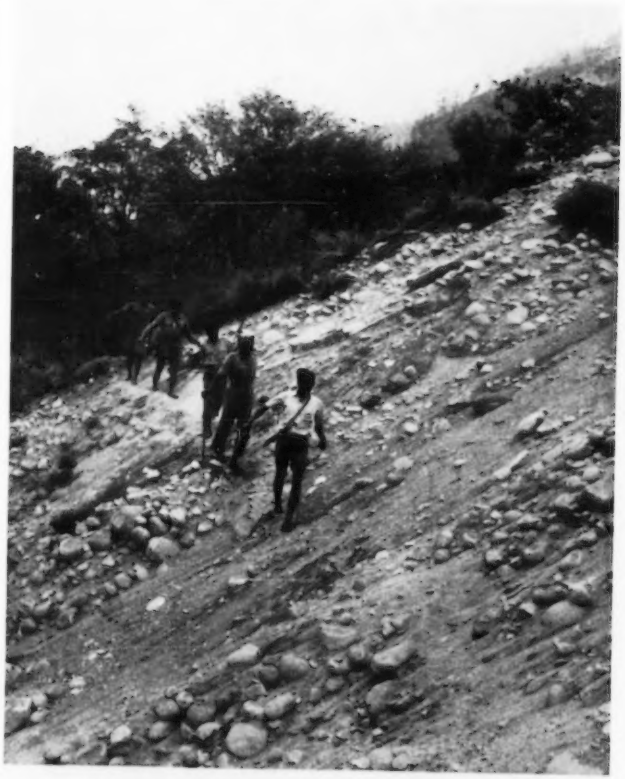
Several years before the earthquake, and during a period of widespread rain in July, I camped by the Lohit between Rima and Walong, and plainly heard the boulders deep down out of sight being moved along and ground together. It was a continuous and sinister noise, heard even above the din of rushing water. This action rapidly produces more sand. During this temporary flood I was held up for thirty-six hours, unable to cross a comparatively small tributary. Further, a sudden movement of sand down the valley has dangerous repercussions, since it leads to an inevitable accumulation and piling up on the edge of the plain, thus raising the river bed. It is this general raising of the river bed of the Brahmaputra which is so fraught with danger: should it be raised above the general level of the surrounding country, Upper Assam would be doomed.[1]

To get some idea of the enormous amount of rock which has been tipped into the Lohit and the Dibang, one need only observe the terrible scars which have been torn in the mountain sides directly enclosing these rivers and their main tributaries, as seen from the air. The Dibang valley and its main tributaries were almost completely denuded of forest from the beginning. This river is likely to give trouble for a generation. But perhaps an even more dramatic example was seen at a point a few miles below Rima, three weeks after the earthquake, when a sandbank was visible above water level at the foot of a vertical cliff. Before the disaster one would have supposed the formation of sandbanks in such a deep and swift river to be impossible (*see* photograph opposite). Lower down the valley, trees growing on stony terraces above normal high water were submerged to their topmost branches. All this may by now be familiar to those on the spot, but it is as well to emphasize it, in order to give a balanced view of what happened, and continues to happen.

Besides the main rivers, a number of their chief tributaries were completely blocked for a time. Those I actually saw were three right bank tributaries of the Lohit, namely the Tidding, Yepak and Sap Chu—all of them blocked for at least twenty-four hours, and probably longer. Eventually the dams gave way, with indescribable results. It is practically certain that many other tributaries, both on the Dibang and on the Lohit, were blocked for a longer or shorter period, though it is probable that nothing quite comparable with the complete holdup of the

[1] Mr. R. C. Reynolds, writing in the Calcutta *Statesman* when he had flown over the flooded plains a few weeks after the earthquake, said that in view of the comparatively un-solid structure of the Assam valley, and the very long duration of the most violent shocks (six minutes at Sadiya), it seemed not impossible that, simply under the influence of gravity, the bed of the Brahmaputra and its banks were brought closer together, inevitably spilling the river over the low-lying surrounding country.

Lohit river below Rima being filled up with sand



Finding a track across a slip in the Lohit valley

Air photo : N. A. B. Warner

Dibang valley: forest stripped from hillsides in Earthquake

Air photo : Jean Kingdon-Ward

7,000 ft. peak in Lohit valley shattered after earthquake

Tidding river for two days, and the appalling devastation which followed, took place anywhere.

There can be no assurance at present that such occurrences will not be repeated. A recent letter from Upper Assam describes the havoc as looking today exactly as it did just after the earthquake, with vast waterlogged swamps on the plain, the trees dead or dying. The stripped hillsides are, many of them, now bare rock on which nothing can grow, except perhaps moss and lichen; here, at least, all that can fall has fallen.

Before going any further, it might be an advantage to describe briefly the nature of the three principal tributary rivers at the head of the Assam valley, so far as these are known. As I have had some experience exploring all three, I write with personal knowledge.

NATURE OF THE RIVERS

The Lohit: This is probably the best known of the big rivers of Assam, although knowledge of its tributaries remains scanty. It is a good thousand miles shorter than the Dihang-Tsangpo, and is divisible into four sections:

(a) *The plains section* of 85 miles, from its confluence with the Dihang (20 miles below Sadiya) to Brahmakund (or Pursramkund) at the entrance to the hills: here the river is 600 yards or more wide. This section calls for little comment. The river in flood spreads out into a network of channels, and for most of the distance the jungle has been cleared from the banks of the main stream—or recently, has been drowned. The current is swift enough to carry coarse sand, and in the rains at any rate it probably rolls small pebbles along its bed.

(b) *From Brahmakund to the great bend at Minzong*, where it swings through 90°—about 50 miles: here the river flows through a deep water-worn valley, with signs of glaciation high up. Numerous large tributaries, especially from the north, help to wear down the average slope to about 45°. There is every indication that the main river itself, above Minzong, was originally one of these tributaries, while the then main river occupied the present valley of the Ghalum.

Evergreen broad-leafed rain forest fills the lower part of the valley, thereby partly protecting the slopes from excessive erosion. The banks and river bed are littered with big boulders at low water, and the current is much swifter than on the plain, and broken by frequent rapids.

(c) *From Minzong to Rima*, just below the confluence of the two main branches—another 50 miles: this is the gorge section. From Minzong northwards the signs of glaciation are obvious enough. The cliffs on one side or the other are often vertical, or almost so, but rarely on both sides at the same time. The Dati Falls, on the left bank a mile above Walong, are about 3000 feet high, the water descending in two magnificent leaps. In places the cliffs recede, where sheets of gravel have accumulated, to be cut into terraces by the river. They are the remnants of moraines and of alluvial fans. A few miles below Rima the gorge widens out into an ancient lake basin.

The forest type in the gorge is a complete contrast to the broad-leafed evergreen rain forest below Minzong. It is pine-oak forest, which extends for 3000 or 4000 feet above the river bed. Only the much narrower tributary valleys are filled with temperate broad-leafed forest. The aridity is due mainly to the cutting off of the south-west monsoon all through the year. *Quercus glauca* is common by the river, but still comes second to pine.

(d) *From Rima to the source*—actually two main sources: I refer here rather to

the western of the two branches, usually regarded as the lesser stream, but nevertheless the only one which unquestionably rises amongst glaciers (called the Rong Thö Chu) about 125 miles. The other branch (the Zayul Chu) is the same length, or a little shorter.

Above the Rong Thö Chu-Zayal Chu confluence, following the former, or western, branch, the features of (c) section are repeated on a more generous scale. There is more and thicker pine forest, but it does not extend so high above the river, being replaced at 6000 feet by a more varied temperate forest type. The valley becomes wider,with a steeper gradient, and the river is frequently interrupted by fierce rapids; gravel terraces are numerous, and better cultivated. The Rong Thö Chu has a heavier rainfall than the combined river below Rima, or the Zayul river above Rima, which is peculiarly arid. This is partly due to the fact that the Rong Thö Chu receives rain from the Delei valley over the Dri Pass.

Between Minzong and the upper Rong Thö Chu, the pine forest has been recklessly burnt, not only in the interest of agriculture—including both clearing for crops and pasture for cattle—but wantonly; especially below Rima. In 1950, fires were burning several thousand feet above the river, and this went on for weeks. While we were at Walong, two small boys set fire to the dry grass, nearly setting off another big forest fire, and keeping the Assam Rifles busy all day preventing damage to crops and to the Outpost.

It may be mentioned that there was a report, well authenticated, to the effect that shortly after the earthquake, a party of men waded across the Lohit near Teju. If true, this extraordinary feat must have coincided with the temporary blocking of the river at Nara, also reported.

The Dibang: This is the smallest, but probably the most unpredictable of the three apical rivers. It is also the least explored. The total length of the main stream is about 125 miles; the greatest breadth of the basis 70–80 miles. It does not pierce the main Sino–Himalayan divide, as do the Dihang and the Lohit (also the Subansiri), and hence does not rise amongst glaciers. However, a large proportion of its flood water between March and June comes from melting snow. The peaks round the sources of the Dibang are of the order of 15,000 to 17,000 feet, and are annually under deep snow down to about 10,000 feet. The whole of its valley is filled with broad-leafed evergreen rain forest below, with temperate forest higher up, and conifer forest above that. The gorges are exceedingly deep and narrow; and owing to the short length of the river in relation to the area of catchment, and the steep gradient in a region of heavy rainfall and snow-melt, the Dibang floods very rapidly. Unfortunately, the degree of slipping here was excessive, and it seems likely to continue for some time. Looking northwards up the valley of the Digaru to the hills, from near Teju, before the earthquake of 1950, numerous large slips were very conspicuous. Whether these were caused by an earlier earthquake, or due to ordinary wear and tear on these precipitous slopes during the monsoon, is unknown. They suggest that the surface skin of the outer ranges is in an unstable condition, ready to slip, carrying with it the forest cover, at slight cause—and that once bare, the scars take a long time to heal: as indeed one would expect.

The stripped hillsides greatly increase the amount and speed of run-off. Whether there is any corresponding increase of surface evaporation is questionable, since the forest itself gets rid of much water by controlled evaporation. It may be assumed, however, that any possible increase in evaporation from the bare surface of a slip will not compensate for the increased run-off. The most serious aspect of every slip is, however, the freeing of the broken surface to leave bare rock exposed at the

least disturbance. This is well seen all up the left bank of the 'Nmai Hka in North Burma.

The Dihang: The name Dihang is given to that portion of the Tsangpo which flows through the Assam hills, south of the main range. It links the Tsangpo, flowing across the outer plateau of Tibet, with the Brahmaputra, flowing through the Assam valley plains. From the frontier, near the Chimdro confluence, to its exit on to the plain at Kobo a few miles below Pasighat, the Dihang is about 180 miles long, and in that distance it falls about 5000 feet—an average of nearly 28 feet a mile. Between rapids the Dihang—often widening out in its big valley—flows fast, but comparatively calmly. Like most of the rivers between the Assam Himalaya and western China, the general direction of the Dihang is from north to south. Its tributaries, most of which rise in glaciers or snow beds, flow in steep-sided narrow valleys; but they have so worn down the main valley that the average slope of the great spurs which plunge down to the river rarely exceeds 40°–45°.

As far north as lat. 29° 45′, the climate of the valley base is of the monsoon type, with heavy summer precipitation accompanied by high temperature, a humid atmosphere, and absence of winter frost. As in the other two valleys, broad-leafed evergreen rain forest occurs up to about 5000 feet, succeeded by a zone of more temperate forest, not very different—at least in appearance—from the sub-tropical zone, except that the trees are smaller.

The main valley of the Dihang is for this region thickly—even over—populated; the only method of cultivation is by *jhuming*, that is, by felling and burning the forest to make clearings, followed by sowing hill rice, maize, buckwheat, or other Himalayan crop. Luckily, wholesale destruction of evergreen rain forest by fire is not possible; but even so, over the years quite a lot of climax forest has been destroyed, up to about 6000 feet; and with the rotation reduced to three or four years, as suitable land decreases and the population increases, the rate of destruction also increases. It is probable that secondary growth of six or eight years standing is effective in checking erosion; in this climate all plants grow fast. But it is doubtful whether in the Abor Hills the rotation practised is anything like six or eight years—it is much more likely to be only two or three. Here we are up against a problem which has not troubled the Lohit or the Dibang—pressure of population on the land, excessive destruction of the forest and, ultimately, serious erosion.

Another danger from *jhuming* (the *taungya* cultivation of Burma) is that it is confined to south and west slopes; north and east slopes remain covered with forest. The result is differential erosion, with consequent formation of cliffs. The Dihang valley is large enough to carry all the water poured into it, and there is no likelihood of any serious damage by water in the valley itself, before the river emerges on to the plain. But that much may be said of the Lohit also, and even of the Dibang. The long, twisting gorge which connects the wide Tsangpo valley in dry Tibet with the Dihang of the Assam hills produces a strong head of water through the hundred miles of gorge, during all seasons; and this certainly helps to keep the Dihang channel open. But the high peaks on either side of the great bend (north of lat. 29°), with their many glaciers, and the spring snow and heavy summer rainfall, give rise to another powerful head of water, threatening flood conditions as soon as the current slows down on the plain.

The powerful Dihang meets the combined Lohit–Dibang at right-angles, and therefore tends to stem and bank up its waters. That by itself is an adverse factor, especially during the food season. One result is to cause a bar to form hereabouts, somewhere between Saikhoaghat and Kobo, where the current is checked.

Thus, apart from the enormous volume of water the Dihang discharges in summer, its behaviour is to some extent dependent upon the behaviour of the Lohit–Dibang—whether the Dihang ponds it back, or absorbs it. No doubt, at certain relative levels of Dihang and Lohit, a maximum amount of water passes Kobo; but this may be quite a rare phenomenon.

EFFECTS ON VEGETATION

At this point it is necessary to say something of the vegetation within the earthquake area, in order to indicate the part which it—or its absence—played at the time of the earthquake, and since. Did it play a conservative role, or not? If so, can reafforestation restore the balance?

Two contrasting vegetation types were directly affected: (i) alpine vegetation, at 12,000 feet and over; (ii) forest, below 12,000 feet.

The forest, however, as already remarked, is not all of the same type. From the botanist's point of view it can be divided into four easily distinguishable types—namely, sub-tropical broad-leafed evergreen rain forest; sub-tropical pine forest; temperate broad-leafed semi-evergreen rain forest; and coniferous snow forest. The last named is, of course, the highest zone, and consists mainly of silver fir, with some larch and spruce (Tsuga), besides a good deal of rhododendron undergrowth.

As the earthquake struck across every zone from 15,000 feet to the bottom of the deepest valley, all types of forest suffered, but some much more than others. Every vegetation type will have to be renewed in its own zone before comparative stability can be reached; there is at least enough forest left to supply all the seeds necessary to replant the devastated areas. Obviously, however, it is going to take a long time, since forest cannot regenerate immediately on raw open slopes; there must be several preliminary stages first. The preliminary stages are the successions, starting perhaps with such simple plants as mosses and lichens, followed by grasses, sedges and annuals, a growth of saplings, and so on. Here wind-borne seeds have an advantage; nor is there any lack of air currents in the mountains to carry them. Amongst trees with wind-borne seeds common in these forests are willows (at all altitudes), poplar (in the Lohit valley at 5000 to 10,000 feet), birch, alder, *Terminalia myriocarpa* (confined to the sub-tropical valleys), rhododendron (temperate zone to alpine), *Bombax malabaricum* (base of foot hills), the conifers, pine, larch, spruce and fir; ash, and many more. But it would be useless to start with these in the mountains.

Under favourable conditions reafforestation can take place rapidly. In 1930 a cloudburst in the mountains produced a mud slide which almost wiped out a village in the Adung valley in North Burma; it just missed the village, but swept over my base camp instead. (Happily I was camped further up the valley at the time.) When I left the Adung valley, there was a fan-shaped delta of semi-liquid mud and stones to mark the spot. I visited the same place seven years later. The village had disappeared—and so had the mud slide. It was thickly overgrown by a grove of alders some 12–15 feet high. But this was at the stable base of the mud avalanche. What had happened higher up I could not tell.

However, in the region we are considering the conditions are anything but favourable. The screes are exceedingly steep, fully exposed, and still moving. There is no soil and no humus. Where stability had been reached—at the foot of a slope—enormous angular boulders were piled on top of each other in utter confusion; and there was (and is) ever the chance of more joining them from above. So far as one

could see at the time, the severity of the destruction depended less on the type of forest than on the angle of slope and nature of the rock. I had expected the more luxuriant sub-tropical forest to hold up the slopes better than, say, the thin sub-tropical pine forest did. But in so far as they were comparable, I could detect no important difference. Incidentally, I was surprised to find that pines—or at least *P. insularis*—were comparatively shallow-rooted trees.

Above Rima there were bare screes, sometimes hundreds of yards across and several thousand feet high, which six weeks after the earthquake were still pouring down rock at almost regular (and short) intervals, during the hours of daylight. This was in the pine forest area, and on very precipitous slopes, at altitudes of 7000 feet and over. But equally severe destruction was apparent near the exit of the Lohit on to the plain, on equally steep slopes. A notable example was when looking across the Lohit from the low col between it and the Tidding valley, where the mountains forming the left bank of the Lohit below the confluence became visible; they were bare for thousands of feet. As for the Tidding valley itself, there was hardly a tree standing anywhere on the left bank.

But though forest could not, in many places, stand up to such a terrific shock, this is not to deny that it held in others, and may have helped to prevent a great deal more damage than actually occurred. Of course, the arrival of millions of tree trunks spewed out from the gorges on to the plain had serious repercussions. In the tributary ravines they formed jams, and even in the main gorges they held up the rivers. On the plain they do more damage, by getting themselves dug in in the sand, though in a less spectacular way. Every such obstacle impedes the flow of water and forms a focus for the accumulation of more sand.

The sudden uprooting of the forest was a disaster. Every tree swept away, or uprooted on the mountain side, left behind a hole full of loose earth and stones, which sooner or later was thrown into the torrent, or produced a running sore; and it became only too obvious that the grip which tree roots held on the soil was at these places worth little more than the disintegration they caused in the surface rock. There is certainly no proof that the slopes which held did so because of the forest cover; but it is at least reasonable to suppose that it helped.

It can then be assumed that reafforestation would, in normal years, be beneficial; forest cover helps to filter the rainfall gradually through the loose surface layers rather than tear holes in it. After all there is no likelihood of another severe earthquake here for very many years. The only question is: how is the reafforestation to be done?

From what has been said, it will be realized that even before the earthquake the nature of the rivers, fed with abundant snow water and passing through an area of extremely heavy rainfall, converging on the apex of a funnel-shaped valley, produced a dangerous situation. Floods on the Brahmaputra are no new experience. There must always have been floods; before 1950 they were serious about every tenth year on the average.

Since the earthquake, serious floods have become an annual event, culminating in the disastrous flood of 1954. The timing of the annual peak rises in level reveal the causes clearly enough: the first rise, about April, is due to snow melt; the second, about July, is due to a combination of snow-melt, increased glacier-melt, and rainfall—and is, of course, much larger than the first. Now, due to the stripping of slopes at high altitudes—10,000 feet and over—with consequent creation of bare screes and more rapid melting of snow, the spring rise tends to be greater, with no corresponding decrease in the summer rise. The increasing erosion in the moun-

tains is of no particular importance; it is erosion on the plains—and by wind rather than by water—that is much more serious. But with this we are not here concerned. What is serious on the plains, however, is the rise in the level of every river bed owing to the vast amount of rock and sand poured into it—that, and anything else that tends to interfere with the free flow of water. At the same time, the loss of fertility in the mountain soils must slow down reafforestation.

COMBATING THE FLOODS

It might be worth while now to consider possible means of combating the floods. These are of two kinds: (i) mechanical; (ii) biological. Remembering that it is impossible to deal with the origins of the floods, it remains to ask only whether anything can be done to diminish their effects on the plains.

Not much can be done with a river the size of the Dihang. The chief weapon here is the power of the river itself to keep open its channel and avoid building up barriers of sand on the plain. There is, in point of fact, an important obstruction in the narrowest part of the gorge not far above the Po–Tsangpo confluence in Pome (Tibet). It is in the form of a thin wall of rock, completely bridging the gorge from cliff to cliff. The river has breached this, but how deep the breach is it is impossible to say. In the winter, the river (which must be incredibly deep here) flows through the slit as through the sluice gates of a lock; but in summer, nothing of the rock would be visible. It seems certain that the blowing up of this barrier would materially increase the flow of the river. It would be a difficult, but not an impossible operation; and as the river is here enclosed between vertical cliffs several thousand feet high, no harm could result. Unfortunately, this is well on the Tibetan side of the frontier, and would require international co-operation.

Curiously enough, there is a very similar stoppage on the Lohit at Nara—a narrow opening between two masses of rock, behind which a small, deep reservoir, considerably broader than the average breadth of the Lohit on this stretch, has formed. At the time when the local Mishmis are alleged to have walked across the river at Teju, the Lohit seems to have been blocked at this point. And since such a block could easily happen again, attention might be directed to this point. It is easily reached, and men could work here safely for weeks in the cold weather. It would be a perfectly safe and quite easy operation to blow it up, thereby helping the flow of the water.

A second defence plan would be to dig a channel from the south bank of the Lohit, east of Saikhoaghat, southwards or south-westwards, to join the Burhi Dihang. True, this might have to be 50–75 miles long; it might, probably would, destroy—certainly imperil—part of the railway between Tinsukia and Margherita, as well as the Trunk Road; and it would be a long and costly job.

But what is the alternative? The Lohit is certainly not the least dangerous river of the three; and there is a strong possibility that under certain conditions it might suddenly, and of its own accord, take a short cut south at or close to this point. The south bank vegetation has been wiped out for miles, both east and west of Sadiya; the river bed appears to be still rising; and in no very long period of time the river may seek relief from butting against the wall of water ahead of it, by doing just that. Alternatively, there is the possibility that in a bad year the Dihang itself might break through west of Saikhoaghat—an unpleasant prospect.

When one recalls that the Hwang-Ho of North China in 1852—and not for the first time—completely changed its course 300 miles from the sea, the possibility

of the Dihang (with equal provocation) doing likewise as it comes rushing out of the hills on to the flat, does not seem fanciful.

As the raising of the river bed is one of the worst threats, and the Lohit valley was badly damaged, a combination of factors making for a heavy flood in this region cannot be lightly dismissed. (Amongst adverse factors I include a heavy winter snowfall followed by a warm spring, early monsoon, and hot summer with heavy and prolonged rain in July or August.) Dredges working near the confluence of the Lohit and Dihang in the cold weather might prove invaluable. If they could remove what I take to be a sand-bar hereabouts—there would need to be several dredgers—much might be achieved. The sand would be dumped on the left bank and help to build up the defences there; and the removal of this bar, and deepening of the channel, would help to get rid of the water quickly. The building of defences at chosen spots on the left bank is an important part of any mechanical defence. Rounded boulders enclosed in strong steel mesh make excellent walls, and can be raised into regular embankments; and the possibility of training-walls to drive the current in a desired direction might also be considered.

All such schemes involve machinery on a big scale, ample labour, and excellent organization. They also demand knowledge of the annual rhythm of the rivers, their rise and fall throughout the year. Those just mentioned apply especially to the Lohit. The Dibang, the only big river whose entire course lies within the Indian frontier, might have to be met differently.

Every vantage point should be used to gain a comprehensive view of the rivers as they approach one another at the apex of the valley, and their behaviour recorded systematically. This also is a long term project. There are many points round the head of the valley where observers could be stationed. So far as the Lohit is concerned, one might suggest the Tidding Saddle (6000 feet), above Dening, as the perfect lookout point. From here, in fine weather, it is easy to follow the course of the Lohit (and of the Kamlang river) for many miles south-west across the plain in the direction of Sadiya. It is like an aerial view. Every channel, its increasing or decreasing breadth, the formation of new channels and suppression of old ones, could be followed step by step, slowly through the months and years. A long term project indeed, but one which may have to be initiated if the Upper Assam valley is not to be converted into a vast swamp, or even a lake.

It remains to enquire if reafforestation of the denuded areas can be undertaken, and whether it would achieve any worthwhile results, in combating the floods, if it were. In this connection it is important to retain a sense of proportion.

The Lohit valley has been quoted for the destruction by fire of much of the pine forest, before the earthquake; and much of the destruction has been assigned to this cause. But the pine forest area is only a very small proportion of the whole region. The earthquake destroyed in a few minutes, outside the pine forest area, more acres of forest than man has destroyed in as many decades—and largely at altitudes where man would not destroy the forest at all. Personally I regard the theory that destruction was more complete in the arid Lohit gorge because, as a result of burning, the forest was particularly thin there, as not proven. If more slips did occur there than anywhere else, it is just as likely to be because the mountains happen to be more precipitous on the upper Lohit.

There is no prospect of sowing seeds from the air in the gorges. It is necessary to fly not less than 3000 feet above the river, between the mountain ranges, except at a few points (*e.g.* at Walong in the Lohit valley), and the proportion of seeds which would reach the right zone for germination would be infinitesimal. Nor

would the seeds germinate at all under the present harrowing conditions; or if a minute proportion did germinate, they would not long survive. However, nature can supply all the seeds necessary for every stage of the succession as soon as the ground becomes receptive, and will do so much faster than man could hope to. It will be many, many years before the big slips become forested again—if they ever do, which is far from certain. But some degree of stability, and some semi-permanent seral stage of vegetation, should be reached long before then.

If, however, the Indian Government considered it worth while to attempt sowing seeds from the air, it would be absurd to start with tree seed, however air-borne. It would be far more realistic to begin with seeds of quick-growing cosmopolitan weeds, including herbaceous perennials and small shrubs—even though there is good reason to believe that such seeds will arrive by normal ecesis. Amongst the former, seeds of Senecio, Artemisia and Cnicus spp., besides other Compositae, are worth trying, as well as various Labiatae such as Pogostemon and *Plectranthus coetsa*; amongst the latter, Myricaria, Vernonia, *Ageratum conyzoides* and possibly Lantana (though its seeds are not wind-borne) might be tried. These lists could, of course, be extended, but I do not think any useful results would be obtained. This is emphatically nature's job. One might remark, however, that in the mountains the aim is not primarily to stop erosion, but to halt slipping; and every plant—even a fern or a growth of moss—helps to some degree to achieve this. As for sowing rhododendron, Abies, Larix, or other high-level tree seed from the air over the mountain tops—apart from the initial difficulty of obtaining some of them in sufficient quantity, one need only remark that five seasons have passed since the earthquake, during which time nature herself will have sown incalculably more seeds than man can sow by any means whatsoever.

Seed sowing on the plains, however, is another matter altogether, and is no doubt practicable by air. Here nature is less helpful, since she has been largely superseded by man in any case. The sowing of seeds along the numerous river banks in the cold weather might give good results. Experiments should be accompanied by trials of controlled sowing by hand, in plots. Sowing should begin well clear of high-water mark, and work gradually towards the river channel; and, of course, if training walls, ramps or embankments were built, efforts should be made to establish vegetation on top of them. The best approach would be to sow seeds of shrubs, especially those that grow socially, on the river side, and trees of rapid growth on the more sheltered side. Shrubby bushes of adaptable species, particularly those which will stand a certain amount of temporary submersion, are obviously a good investment. Shrubs like Myricaria sp., *Homonoia riparia*, Ficus spp. (*e.g. FF. lanceolata, pyriformis, heterophylla*), *Litsaea angustifolia*, Phyllanthus, Eugenia, and many others, are worth trying.

The above assessment of the overall position can be summarized as follows:

(1) The origin of the floods (except, theoretically, in the Dibang valley) lies beyond the Indian frontier; the chief results are seen on the plains of Assam.

(2) A number of factors are involved. If all were adverse in any one year, the results might be catastrophic—so much so that Lakimpur might become uninhabitable, and the head of the Assam valley converted into a vast swamp.

(3) Nothing can be done, even by international action, at the real sources of the floods,[1] though stand-by warnings might be obtained thence, and would certainly prove useful.

(4) Floods on the Brahmaputra have always occurred; the earthquake seriously

aggravated them. They may be expected annually for an unpredictable number of years.

(5) To save Upper Assam, various long-term schemes should be put in hand. They would be expensive, but some relief might be expected locally. No quick results are likely.

(6) Use should be made of the outpost platoons, especially in planting, and in revetting screes.

(7) In the mountains the main objective must be to hold up the slips. Direct reafforestation here is not possible; it is a stage-by-stage long-term project, the ultimate climax of which is a return to forest. This may take several centuries.

(8) On the plains the main objective is to flush the main channels as often as possible, in the hope of deepening them and keeping them open, not permitting the water to dissipate its power over the countryside. This applies particularly to the Lohit river.

The above is a short but realistic view of the problem, as I see it after experiencing the earthquake in Rima, and having to get out of the mountains afterwards.

[1] The one exception known to the author is that mentioned on p. 300.

FURTHER LIGHT ON THE MOLYNEUX GLOBES

HELEN M. WALLIS

MORE FACTS about the history of the globes by Emery Molyneux (1592) have come to light since an article on them appeared in the *Journal* in 1951.[1] Their engraver Jodocus Hondius, returning to Amsterdam in 1593, obtained on the first of April 1597 a ten years' privilege to make and publish a terrestrial globe.[2] In the same year he published at Amsterdam a translation into Dutch of the 'Tractatus de globis' (1594) by Robert Hues. The very rare first edition of Hondius's translation, printed by the Amsterdam publisher Cornelis Claesz., has the title:

> "Tractaet Ofte Handelinge van het gebruijck der Hemelscher ende Aertscher Globe. Gheaccommodeert naer die Bollen, die eerst ghesneden zijn in Enghelandt door Io. Hondium, Anno 1693 [3] ende nu gants door den selven vernieut, met alle de nieuwe ontdeckinghen van Landen, tot den daghe van heden geschiet, ende daerenboven van voorgaende fauten verbetert. In't Latijn beschreven, door Robertum Hues, Mathematicum, nu in Nederduijtsch overgheset, ende met diveersche nieuwe verclaringhe ende figueren vermeerdert en verciert. Door I. Hondium."

Described as "a little book for the right understanding of these globes," [4] the 'Tractaet' was produced, like its Latin original, as a companion to the Molyneux globes. Although Hondius referred in his application for a licence (as also in the title and preface of the 'Tractaet') to the globes he had engraved in England, and called his present globe, apparently in distinction to these, "a new globe, drawn and engraved by himself, purged of all faults," [5] and "incorporating all the new discoveries," [6] this globe was not new but revised. For it is clear that Hondius had with him in Amsterdam the plates of the Molyneux globe gores and was now publishing the globes in his own name. He was thus responsible for the revised edition of the terrestrial globe, of which the Middle Temple globe of 1603 is the only surviving example.

Part of the evidence in support of this is furnished by documents relating to a lawsuit between Hondius and the rival Dutch globe-maker Jacob van Langeren. When in 1597 Van Langeren contested Hondius's privilege, Hondius countered by enumerating fourteen important additions to geographical knowledge displayed on his globe and not on that of Van Langeren.[7] Three of these, the discovery of Frobisher's Strait, Davis Strait and Raleigh's "Virginia," are represented on the Petworth globe in its original state; the others, added as revisions to the plate after the publication of the globe in 1592, appear only on the Middle Temple globe. In

[1] Wallis, H. M., "The first English globe: a recent discovery," *Geogr. J.* **117** (1951) 275–90.

[2] Japiske, N., 'Resolutiën der Staten-Generaal van 1576 tot 1609.' No. 9. *Rijks Geschiedkundige Publicatiën* 62 (1926), 705.

[3] A misprint for "1593"; corrected in the second edition of the 'Tractaet' (1612).

[4] 'Tractaet' (1597), sig. Aii[r].

[5] Japiske, 'Resolutien,' No. 9 (1926), 705.

[6] Jonge, J. K. J. de, 'De Opkomst van het Nederlandsch Gezag in Oost-Indie (1595–1610),' I (1862), 78.

[7] Jonge, I (1862), 179–80.

South America Hondius incorporated Raleigh's discoveries in Guiana, 1594–96, and some new names of provinces in Brazil, such as Morpion, Ouecatates, Tauoupinam Bautu, and Margaiates, which he took from the descriptions of Jean de Léry and Villegagnon.[1] A great lake drawn in the interior of Brazil was derived, as were many new place-names in Peru, along the Strait of Magellan and elsewhere, from a chart of Ludovico Teixeira (one probably resembling the chart by Teixeira, preserved in the Biblioteca Nazionale at Florence,[2] which shows marked similarities to the delineations on the globe). Teixeira's name also appears as Hondius's source for the representation of "all the new islands west of Terra Nova" (which the globe, however, does not appear to show) and for improvements in the Far East. These include the addition of a long island named Corea off the coast of China, resembling the "Corea Insula" of Teixeira's map of Japan published in the 'Additamentum V' (1595) of the 'Theatrum Orbis Terrarum' of Ortelius, although Japan, revised after Teixeira according to Hondius's list, still retains the distortion of Vaz Dourado's delineation of 1568.[3] Some new place-names on the African coast also appear to have been taken from Teixeira,[4] but most of the additions in Africa (amounting to about forty-five names) were from the maps of Pigafetta.[5] The north-east passage was the region of Hondius's most comprehensive revision. Here, obliterating the existing configuration, he replaced it with a representation of the discoveries made on Barents's third voyage to Novaya Zemlya, 1596. This was the exception to the general rule, for the revision was mainly superficial, taking the form of additions which in some places, as in "Corea," were superimposed on earlier names. It transformed, nevertheless, the appearance of the globe, affecting every continent, and running to the addition of more than a hundred new place-names. With the exception of Terra Nova and Japan, every improvement mentioned in the list is incorporated in the revision of the globe. Conversely, there is no major revision on the globe not in the list.

The agreement between the list and the globe suggests that the revision of the plate was completed by 1597. In support of this, not only are the additions based on sources which could have been available to Hondius in 1597 or earlier, but they also fail to take account of discoveries made or reported after 1597. Thus the delineation of Raleigh's discoveries in Guiana (the first printed graphic representation, for the two published accounts 'The Discouerie of the large, rich, and bewtiful Empyre of Guiana' by Raleigh (1595), and 'A Relation of the Second Voyage to Guiana' by Keymis (1596), were not illustrated) resembles that of the MS. map of Guiana[6] which was perhaps drawn by Raleigh himself. Unlike

[1] Léry, Jean de, 'Histoire du voyage fait en la terre du Brésil' (1578), 45, 52–3, 340–1. Villegagnon, Nicolas Durand de, 'Copie de quelques letres sur la navigation du Cheuallier de Villegaignon . . .' (1557), 24.

[2] Caraci, Giuseppe, "Cimeli cartografici sconosciuti esistenti a Firenze," *La Bibliofilia*, XXVII (1926), 46–52. Cortesão, Armando, 'Cartografia e cartógrafos portugueses dos séculos XV e XVI' (1935), II, pl. LIV.

[3] See Dahlgren, E. W., "Les débuts de la cartographie du Japon," *Archives d'Études Orientales*, 4 (1911) 41–65.

[4] This is suggested by a comparison of the globe with the engraved map 'Tabula Aphricae nova, sumta ex operibus Ludouici Tercerae . . . Joannes a Duetechum iunior fecit,' dated *c.* 1590 in Jan Denucé, 'Oud-Nederlandsche Kaartmakers in betrekking met Plantijn,' I (1912), 206.

[5] Published in Lopez, Odoardo, 'Relatione del Reame di Congo et delle Circonvicine Contrade. Tratta dalli Scritti a ragionamenti di Odoardo Lopez Portoghese per Filippo Pigafetta' (1591).

[6] B.M. Add. MS. 17940.

Hondius's map of Guiana, 1599, and its derivatives, which displayed Keymis's discoveries of 1596 and followed his identification of the lake of Manoa with lake Parima, the globe neither gives the name Parima nor shows the Essequibo river. On the other hand, Barents's discoveries appear to have been copied from Gerrit de Veer's map which was engraved by Baptista à Doetechum and not published until 1598.[1] There is evidence, however, that Hondius had access to Doetechum's MS. sources, for the publisher of Hondius's 'Tractaet,' Cornelis Claesz., also published the first edition of the account of Barents's voyages, 'Waerachtighe Beschryvinghe van drie seylagien . . .' (1598), with Doetechum's engravings.[2] To almost every revision on the Middle Temple globe there is, in fact, a corresponding work published by Claesz. from an original which could have been Hondius's source and would probably have been available to him before 1597. Thus in 1597 Claesz. published the Dutch translations of De Léry's description of his voyage to Brazil and of Filippo Pigafetta's description of Odoardo Lopez's travels in Africa; for the translation of Lopez, Hondius himself engraved the map on the title page. In 1598 Claesz. published Dutch editions of Raleigh's and Keymis's works on Guiana,[3] and in 1604 a world chart by Teixeira[4] (of which no copy appears to have survived) which might have been the map Hondius used. It seems therefore that Hondius made use of the resources of Claesz.'s bookshop to bring the globe gores up to date.[5] Why he failed to keep them up to date after 1597 is a mystery, for he did finally obtain a privilege for the globe for ten years on 31 October 1598.[6] in spite of Van Langeren's efforts to annul his former privilege. Yet he turned to the production of entirely new globes, designed for the Dutch market, of which he published the first pair in 1600. It may be conjectured that in 1603 he received from England an order for a pair of globes (whether from the Middle Temple or not we do not know) and that he thought it appropriate to provide a pair from the plates of the Molyneux globe gores, on which he altered the date of the terrestrial to 1603 and made no other revision. The one revision of the Middle Temple globe for which no date can be definitely assigned is the change in the wording of the title, but this may well have been made in England before Hondius acquired the plates,[7] for the Petworth globe names Molyneux and Hondius as author and engraver, while the Middle Temple globe associates William Sanderson's name with that of Molyneux.[8] It would be unlike Hondius, on his own initiative, to withdraw his name in favour of another's.

[1] *Geogr. J.* **117** (1951) 281.

[2] Tiele, P. A., 'Mémoire bibliographique sur les journaux des navigateurs néerlandais' (1867), 103–4.

[3] Tiele (1867), 302–5.

[4] Destombes, Marcel, 'Cartes Hollandaises' (1941), 7.

[5] How extensive these were is shown by the 'Catalogus Librorvm Qvi apvd Cornelivm Nicolai venales reperiuntur' which Claesz. published in 1604. See "De boekhandel van Cornelis Claeszoon in 1604" in *Nieuwsblad voor den Boekhandel*, 1910, No. 9, 149–50, No. 10, 166–7; W. P. Van Stockum, Jr., 'La librairie, l'imprimerie et la presse en Hollande à travers quatre siècles' (1910), figs. 15–18; and M. M. Kleerkooper and W. P. Van Stockum, Jr., 'De Boekhandel te Amsterdam voornamelijk in de 17e eeuw' (1914–16), 126, 1223–5.

[6] Jonge, I (1862), 78–9.

[7] That textual alterations were made in England is proved by the fragments of gores in a revised state found inside the Petworth globe. See *Geogr. J.* **117** (1951) 281.

[8] The attribution of the pair of Molyneux globes at Kassel to Sanderson suggests that the terrestrial (now destroyed), like the celestial, mentioned Sanderson's name in the title. Gerland's description of the globes refers only to Sanderson. A. Coester and E. Gerland 'Beschreibung der Sammlung astronomischer, geodätischer und physikalischer Apparate im Königl. Museum zu Cassel' (1878), 15, Nos. 21 and 22; and E. Gerland, "Beiträge zur Geschichte der Physik," *Leopoldina* (1882), 69.

That Hondius ceased to revise the globes after 1597 explains why the celestial globe of the Middle Temple pair is not revised at all. Up to the beginning of August 1597 no discoveries had yet been made known which superseded the observations represented on the globe in its first state of 1592. These were not original, as the globe was an almost exact copy of Van Langeren's celestial globe of 1589. This, although mainly following Mercator's of 1551, incorporated as its one original feature the new constellations of the Southern Cross and Triangle. The author was Peter Plancius, as Merula [1] stated in 1605, a fact which explains the similarity of the Molyneux globe to the Plancius hemispheres of 1592.[2] Plancius drew the new constellations in positions which he admitted (in the title legend) to be conjectural, and were in fact too far west. When at Plancius's request more accurate observations were made by Pieter Dircksz. de Keyser (Petrus Theodorus) on the first Dutch voyage to the East Indies (April 1595 to August 1597), these were handed over by Plancius to Hondius, who was the first to publish them on his celestial globe of 1600. He moved the Cross and Triangle eastward, and though in 1605 Merula [3] commented on the divergent practices then prevalent, the positions adopted by Hondius in 1600 and by Blaeu in 1602 were accepted henceforward. Although Hondius did not alter the plates of the Molyneux celestial globe, he did revise the title page of the 'Tractaet,' dropping in the later editions the celestial hemispheres which showed the Southern Cross in the wrong position and replacing them by a side view of the globe which is tilted to display in detail only the northern hemisphere.

Such is the documentary and cartographical evidence for the association of the later history of the globes with Hondius and Amsterdam. To the question of how Hondius acquired the plates Molyneux's own activities appear to provide the answer. Molyneux was himself in the Netherlands at the time that his terrestrial globe was being revised and a privilege sought for it in Hondius's name. He was still in England on 27 September 1594, when a warrant was issued to pay Thomas Bayly and Emery Molyneux £200 as the Queen's free gift.[4] He must have been still there on 4 March or 26 April 1596, as these dates endorse an offer he sent to Lord Burghley of his invention of "a piece of great Ordonance." [5] This means that he left England some time between March or April 1596 and 4 June 1597, the date of a grant by the Queen of an annuity of £50 to John Durning, "on surrender of Emery Molyneux" [6] (a grant recorded again, in (?) 1599).[7] That he emigrated to the Netherlands with his wife is proved by a ten years' privilege he received on 26 January 1598 from the States General in Amsterdam for the invention of a cannon [8] (a demiculverin which appears to be the same invention as that offered to Burghley), and by the grant of a pension to his widow of 50 florins, from

[1] Merula, Paullus, 'Cosmographiae Generalis Libri tres . . .' (1605), 106. The title legend of the only surviving example of the globe (now at the National Maritime Museum, Greenwich) gives Plancius's name as the author, confirming Merula's statement.

[2] *Geogr. J.* **117** (1951) 284.

[3] Merula (1605), 106.

[4] C.S.P. Dom. 1591–4, p. 557.

[5] B.M. MS. Lansdowne 101.17. The date 26 April 1596 appears to be written in a different hand, and may not be an endorsement by Molyneux.

[6] C.S.P. Dom. 1595–7, p. 433.

[7] C.S.P. Dom. 1598–1601, p. 368.

[8] Japiske, 'Resolutiën,' No. 10. *Rijks Geschiedkundige Publicatiën*, **71** (1930) 370. This Resolution describes him as an "Engels edelman" (English gentleman). Dr. J. Keuning reports also that he has found Molyneux's request in the 'Acte-boeck' of the States General.

compassion, on 9 April 1599;[1] he died between 6 June 1598, the date of a second application relating to his privilege,[2] and 9 April 1599. From these facts it seems almost certain that Molyneux took the plates of the globe gores with him to Holland and handed them over to Hondius in 1596 or early in 1597, for if Hondius had taken the plates to Amsterdam in 1593, it is most unlikely that he would not soon afterwards have set about publishing them and securing a licence for this purpose. Molyneux must have sold the plates to Hondius, hence Hondius's references exclusively to himself as their author. After buying the plates of the globe gores Hondius would have no further legal obligation to acknowledge Molyneux. A parallel example is his purchase of the plates of Ashley's 'Mariners Mirrour' (1588), which he reissued in Holland in 1605.[3] That he also suppressed Molyneux's name in referring to his own engraving of the globes in England is in keeping with his character; he was notorious for his disregard of other authors' rights, losing the friendship of Edward Wright on this account. There is no reason therefore to suppose that Hondius rather than Molyneux was the author of the globes in their original state. The roles of the various collaborators in the construction of the globes is admittedly obscure. It is puzzling that Molyneux should be known for no other cartographical work, for if the globes were his only production, they were a remarkable achievement. Yet no further evidence of his cartographical activities has come to light. All the new information uncovered relates to his work as a maker of ordnance,[4] a profession which was often combined with that of the mathematical instrument-maker. Molyneux's authorship of the globes has, however, the incontestable authority of Hakluyt and of Sir William Sanderson,[5] who in 1656 wrote of Molyneux and Edward Wright as the men who persuaded his father to be the globes' financial sponsor. Probably Molyneux collected the contemporary sources, such as the map of John Davis's discoveries and Hariot's map of Virginia, and Hondius, as the engraver, had the task of compilation. It is possible even that Molyneux helped Hondius in 1596 or 1597 with the revision of the globes. If, for example, Hondius secured a copy of Raleigh's map of Guiana, Molyneux is his most likely source. By the time Molyneux left England Hariot had drawn up from Raleigh's notes a chart which (on 11 July 1596) had yet to be completed with Keymis's discoveries.[6]

It is not known why Molyneux decided to emigrate to the Netherlands. If he was tempted by the greater opportunities provided there by the advanced state of geographical and mathematical sciences, these brought, however, the corresponding disadvantage of greater competition. In England the Molyneux globes as the first English globes were alone in the field. In the Netherlands they appeared as unwelcome interlopers. It was natural that Hondius's privilege should at once have been challenged by the Van Langerens, who had lately established their preeminence in globe-making. They had good grounds for claiming that the privilege contravened that granted to Jacobus Florentius himself on 9 September 1592 for

[1] Japiske, 'Resolutiën,' No. 10 (1930), 825.

[2] Japiske, 'Resolutiën,' No. 10 (1930), 370 footnote.

[3] Crone, G. R., " 'The Mariners Mirrour' 1588," *Geogr. J.* **119** (1953) 457–8.

[4] Molyneux's offer of the new cannon to Burghley contains a list of other military inventions, some for naval warfare, endorsed "Seruices offered unto the Queenes most excellent Mtie." Lansdowne 101.art.17. C.S.P. Dom. 1547–80, p. 399, gives in a list of undated items, 1570?, "Note of services offered to the Queen by Emery Molyneux of new inventions of shot and artillery, to be used principally in naval warfare."

[5] Sanderson, Sir William, 'An answer to a scurrilous pamphlet' (1656), sig. A.3v.

[6] Edwards, Edward, 'The Life of Sir Walter Raleigh,' II (1868), 420.

his globes of 1589 and renewed for him and his sons Arnoldus and Henricus in 1596. A privilege was designed to protect an author's "copy-right," and not only was Molyneux's celestial globe a copy of Van Langeren's of 1589, but the terrestrial also followed the terrestrial of Van Langeren's pair as one of its main authorities in such areas as Africa, where Molyneux had no special information from English or Spanish sources. It also exhibited a system of loxodromic lines which was a feature of Van Langeren's globes and one for which he claimed priority of invention (although the lines had already appeared on Mercator's terrestrial globe 1541, one of Van Langeren's sources). That the privilege of the Van Langerens was based on this alleged invention was stated in a decree of the States General of 31 December 1597, relating to the dispute between Hondius and the Van Langerens.[1] Probably it was on the strength of this invention that Van Langeren claimed his globe to have served better than sea-charts in enabling Dutch navigators to reach Pernambuco in Brazil, the island of St. Thomas, the island of Principe, and other places.[2] It would be a reasonable claim, since the loxodromic lines of charts, unlike those of the globe, were not true lines of direction until Mercator's projection was applied to charts by Wright and Hondius. Hondius also thought the device useful for navigators, for new lines were added to the plates of the Molyneux terrestrial globe gores at some stage and appear on the Middle Temple globe; further, in addition to showing them on his later globes, he devoted legends to explanations of their use. Whether Van Langeren complained of the other features which were copied from his globes is not clear, but it is significant that Hondius put forward the list of fourteen points in which his globe was superior to (and therefore different from) Van Langeren's as an appendix to an "apology and answer." [3]

The history of the dispute is not fully recorded.[4] A resolution of the States General of 23 August 1597 stated that the request of the Van Langerens for the annulment of Hondius's privilege should be placed in his hands and that he should prove within eight days of the receipt that the concession granted him did not prejudice that granted to the Van Langerens. Both sides pleaded before the States General, and Hondius appears to have lost the first round, since the decree of 31 December 1597 stipulated that because the system of loxodromic lines was the Van Langerens' invention, they should enjoy the privilege provisionally. If Hondius found himself damaged by the decision, he was to bring an action against it by law before the Magistrate of Amsterdam. In the ensuing argument the Van Langerens urged that Hondius's plates and all other equipment be confiscated from his house, but the Magistrate requested greater discretion. The outcome is not known, except that Hondius got a privilege on 31 October 1598.

Although the Moyneux globes were so soon superseded by new globes, they continued to exercise an indirect influence on Dutch globe-making. Hondius's globes of 1600 and 1601 and the pair published by his sons Henricus and Jodocus in 1613 (with loxodromic lines laid down by Adrian Veen) displayed many features derived from the Molyneux globes. The Van Langerens themselves incorporated

[1] Kramm, Christiaan, 'De Levens en Werken der Hollandsche en Vlaamsche Kunstschilders . . .,' II (1859), 721.

[2] Jonge, I. (1862), 77.

[3] Jonge, I. (1862), 78.

[4] The following account is taken from Jonge, I (1862), 78–9, supplemented by Kramm, II (1859), 720–21, and J. J. Dodt, "Letterkundig verslag van hetgene uit de landspapieren kan worden geput, om daarna de verdiensten van P. Plancius . . ." in Tindal, G. A., and Jacob Swart, *Verhandelingen en berigten betrekkelijk het Zeewezen en de Zeevaartkunde*. Nieuwe Volgorde, V^e deel (1845), 86–88.

on their globes of 1612 the improvements which Hondius had enumerated in his list.[1] It is probable also that the Hondius globes of 1613, which were 55 centimetres in diameter (slightly smaller than those by Molyneux) stimulated Blaeu to make his large globes published in 1622, and probably begun in 1616; these, 67 centimetres in diameter, were the largest globes yet made. Blaeu, Hondius's new rival, also went to law against Hondius, seeking on 8 August 1608 protection against individuals who were copying his productions.[2] A final comment on the fortunes of the Hondius family in globe-making is provided by a decree of 12 October 1613. This rejected a request of Jodocus Hondius the younger to give each gentleman of the States General a pair of great globes, which he had previously given to members of the Council of State. The Notary was ordered instead to tell the Council of State and Treasury of the Generality that henceforward they should accept no similar gifts, in order not to embarrass the country with useless expenses.[3]

The indirect contributions of the Molyneux globes to Dutch globe-making do not compensate for the loss to English cartography. Had the globes remained in England there is no reason why they should not have remained in production for many years, as did the copper-plates of the atlases of Saxton and Speed. Instead they established no tradition of globe-making. No more globes appear to have been made until the 1670's, when Morden and Berry were publishing globes 3 inches, 10 inches and 15 inches in diameter, and Joseph Moxon globes 6 inches, 8 inches, 15 inches and 26 inches in diameter. Of these only the 26-inch globes of Joseph Moxon were comparable in size to the Molyneux globes, and it is possible that Moxon's globes were based on Blaeu's.[4] In the meantime Englishmen had to be content with imported foreign globes. The ninth Earl of Northumberland acquired a pair of Blaeu's large globes of 1622, which still survive at Petworth as companions to the Molyneux globe of 1592. When the Earl of Arundel was painted by Van Dyck probably in 1639 or 1640 [5] with a globe set to display the Indian Ocean and to symbolize his project of colonization in Madagascar, the globe was also a Blaeu globe of 1622 or the later edition of 1640. There is thus some reason to regret that the plates of the globes left England so soon, in despite of all the talent and expense bestowed on them and the hailing of their publication by Shakespeare, Hakluyt and the Queen. It is all the more creditable that the Middle Temple secured directly or indirectly from Holland and preserved so well a pair of the revised globes, the finest globes of their time, and (incidentally) the means by which this later history of the Molyneux globes has been unravelled.

APPENDIX

For various suggestions and corrections relating to my previous article, I wish to express my thanks to a number of correspondents. Dr. M. E. Seaton, Fellow of St. Hugh's College, Oxford, drew my attention to MS. Lansdowne 101.17. It was hoped that this would provide a holograph signature by Molyneux, and, if so, it would show whether he was the copyist of the rutter in MS. Sloane 2292.[6] The letter

[1] Wieder, F. C., "De globe van Van Langren, Ao 1612," *Tijdschrift van het Koninklijk Nederlandsch Aardrijkskundig Genootschap*, tweede serie, deel XXXII (1915), 231–39. Stevenson, E. L., *Terrestrial and celestial globes* (1921), I, 208–9.

[2] Baudet, P. J. H., 'Leven en werken van Willem Jansz. Blaeu' (1871), 156–8.

[3] Kramm, II (1859), 721.

[4] Moxon was in Amsterdam in 1675, not long after the fire (1672) which led to the sale of Blaeu's plates. The sizes of Moxon's globes correspond to those by Blaeu, allowing for the fact that Moxon gave the figures to the nearest inch.

[5] Hervey, Mary F. S., 'The Life, Correspondence and Collections of Thomas Howard, Earl of Arundel' (1921), 418–9.

[6] *Geogr. J.* **117** (1951) 278.

to Burghley is in secretary hand, however, and it is impossible to say whether this, or the other hands of the document, is Molyneux's holograph, nor is there any obvious similarity between the hands of MS. Lansdowne 101.17 and those of MS. Sloane 2292. Dr. J. Keuning of Schiedam, Holland, gave me the reference to Molyneux's application for a patent from the States General of the Netherlands 26 January 1598, together with details of the first edition of Hondius's 'Tractaet' (1597), a copy of which has now been secured by the British Museum. Professor E. G. R. Taylor has pointed out that Thomas Hariot did not contribute the fifth part to Hues 'Tractatus de Globis' (1594), contrary to my assertion,[1] in which I followed Sir Clements Markham in the Hakluyt Society edition of Hues.[2] The expected chapter by Hariot "On the Rhumbs" not being forthcoming, Hues provided his own account meanwhile, as he explains in a note appended to the fifth part.[3] A point relating to Hakluyt's remarks on Molyneux's terrestrial globe in his 'Principall navigations' (1589)[4] is made by Professor D. B. Quinn. As this work did not appear until at least after January 20, the preface may belong to the year 1590, and therefore agrees with the date when Hariot and Molyneux were in association, as suggested by Hariot's note at the end of MS. Sloane 2292. A sheet of vellum appended to the end of the MS. has a memorandum in Hariot's hand containing the date 1596 and a reference to Hakluyt, amongst others: "Mr. Hackluit/of Canada & some mappes of it./A rutter of the river of Plate./ A plot of the Caspian Sea." Another document worth noting is an undated letter written by William Sanderson to the Universities of Oxford and Cambridge presenting them with a pair of Molyneux globes.[5]

I am indebted also to Dr. John W. Shirley of Raleigh, North Carolina, for further information on the activities of Raleigh, Northumberland and the three Magi in the Tower,[6] where the Petworth globe certainly spent its early years until 1622. Dr. Shirley shows that the group of scholars round Raleigh and Northumberland was neither as early in foundation nor as formal as John Aubrey and Anthony à Wood made out. The chemical experiments carried out were directed, moreover, not towards the disinterested pursuit of science but to the furnishing of drinks for Northumberland's lavish table, the little hen house in the Lieutenant's garden having been turned into a distillery. That the geographical studies (and those in anatomy and medecine) were more compatible with the picture handed down by literary tradition is, however, indicated by a large number of entries in Northumberland's accounts relating to expenses incurred for geography and cosmography, including payments for "Mendinge the globes and spheres at the Tower" (1596), "Globes ij paires lvij^{s} vj^{d} for cutting & devidinge a brasen scale xij^{s} for mendinge and scowringe the brasen spheres viij^{s} for mendinge the globes xviij^{s} ij^{d}" (1615). These suggest that the Petworth globe was then, and probably from the beginning, in Northumberland's library, not Raleigh's.

For the globes themselves the main correction to my earlier article, as this second one shows, is the reassessment of the extent and importance of the revision of the terrestrial globe. No further copy of the terrestrial globe has turned up, but a Molyneux celestial globe (1592), previously recorded as a "Hondius" globe of 1592, is in the Germanisches National-Museum, Nuremberg. The total surviving examples now known number two terrestrial and three celestial. It is just possible that there may be others on the continent entered under the names of Hondius or Sanderson and not identified as Molyneux globes.

I wish also to express my thanks to Mr. R. A. Skelton for his kind help.

[1] *Geogr. J.* **117** (1951) 287.

[2] Hues, Robert, 'Tractatus de Globis' (Hakluyt Society, 1889).

[3] Hues, Robert, 'Tractatus de Globis' (1594) 111.

[4] I wrongly referred to this as the first *volume* of the 'Principal Navigations,' *Geogr. J.* **117** (1951) 276.

[5] British Museum, MS. Julius C.V. fol. 385.

[6] See "The Scientific Experiments of Sir Walter Raleigh, the Wizard Earl, and the three Magi in the Tower 1603–1617," *Ambix*, vol. 4, Nos. 1 and 2 (1949), 52–66.

THE HAZARAS OF CENTRAL AFGHANISTAN

WILFRED THESIGER

I WENT TO Afghanistan in the summer of 1954 from southern Iraq, where I had been for six months among the marshmen. There I had been living in semi-submerged houses and moving about in a canoe; now I was anxious to stretch my legs on the mountain tops. In 1952 and 1953 I had travelled in the Hindu Kush and Karakoram, in Chitral, Gilgit and Hunza, and had long wished to make a similar journey in the Hazarajat of Afghanistan.

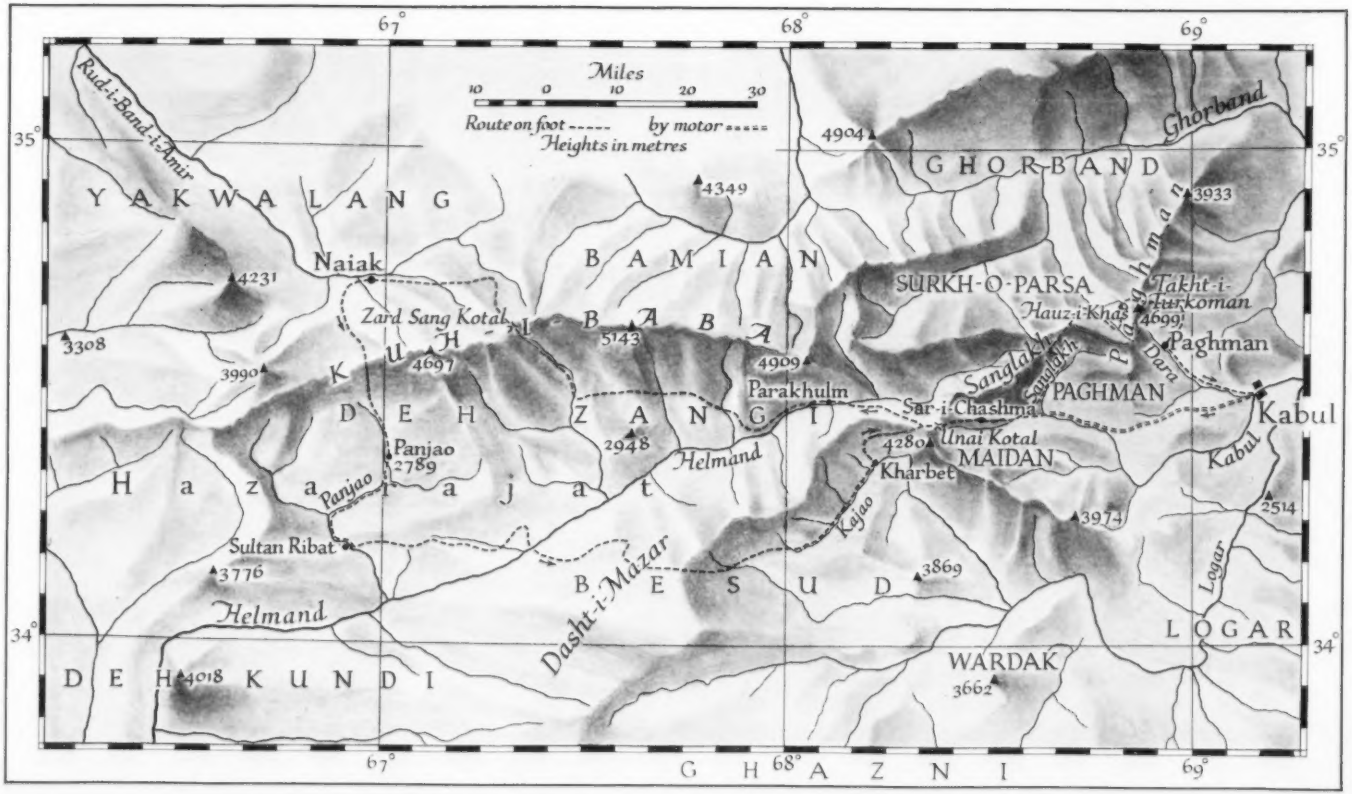
The Hazarajat includes mountains rising up to 17,000 feet, which have been little visited by Europeans, and is inhabited by the Hazaras, an interesting and little known race. The Afghan Government gave me permission to travel there and provided me with an interpreter, whose name was Jan Baz. We left Kabul on August 10 for a six weeks' journey. We travelled on foot, accompanied by a Sayid from the Maidan with a pony on which we loaded our kit. Starting from the Unai Kotal, at the head of the Maidan, and crossing the Helmand, near Parakhulm, we worked our way upwards along the southern slopes of Kuh-i-Baba until we crossed this mountain by the Zard Sang pass. We then visited Naiak, recrossed Kuh-i-Baba to Pajano, and followed the Panjao river down to Sultan Ribat; here we were forced eastwards by impassable gorges and had some difficulty in getting back over the Helmand. We then climbed up through some very broken country to the northern edge of the Dasht-i-Mazar, which we skirted before descending the broad and fertile valley of the Kajao to Kharbet. From there we went to Unai Kotal, down to Sar-i-Chashma and up the Sanglakh valley. We then crossed the steep mountain range on the north side of the valley into Surkh-o-Parsa, recrossed this mountain range to the north of Takht-i-Turkoman, and descended from Hauz-i-Khas [1] to Paghman and Kabul. During this journey I travelled in Deh Zangi, Besud and in a corner of Yakwalung, but I did not enter Deh Kundi, the fourth district of the Hazarajat.

During this journey I collected all the plants which I saw in fruit or flower; my collection, which numbers 211 specimens, is in the British Museum of Natural History, and includes cereals and vegetables grown by the Hazaras. The number of plants found in the autumn was bound to be limited but they proved to be of considerable interest.

On my return to London I read all that I could find about the Hazaras,[2] which was surprisingly little. In the Gazetteer of Afghanistan (1882) there are thirteen

[1] Near the top of Takht-i-Turkoman are the pools of Hauz-i-Khas. These small pools, although locally famous, are uninteresting. They are made by melted snow and lie among the debris which has fallen from the steep granite cliffs which surround them on three sides. They are at about 14,000 feet and can only be reached from the Kabul side of the mountain after a long steep scramble. Hindus from Kabul visit these pools once a year on pilgrimage. Early in September 1954 more than a hundred Hindus performed this pilgrimage.

[2] In 1903–4 the Indian Government raised a battalion of Hazara Pioneers under Major C. W. Jacob (later Field-Marshal Sir Claud Jacob, G.C.B., G.C.S.I., K.C.M.G.), from Hazara refugees from Central Afghanistan who had crossed into British India. The battalion was disbanded in 1933 after serving on the Frontier, and in France and Mesopotamia in the First World War. There is an interesting pamphlet "A brief history of the 106th Hazara Pioneers (1A)" by Brigadier N. L. St. Pierre Bunbury, D.S.O., in the Library of the India Office. It is noteworthy that the Hazara Pioneers were probably the best shooting regiment in the Indian Army.



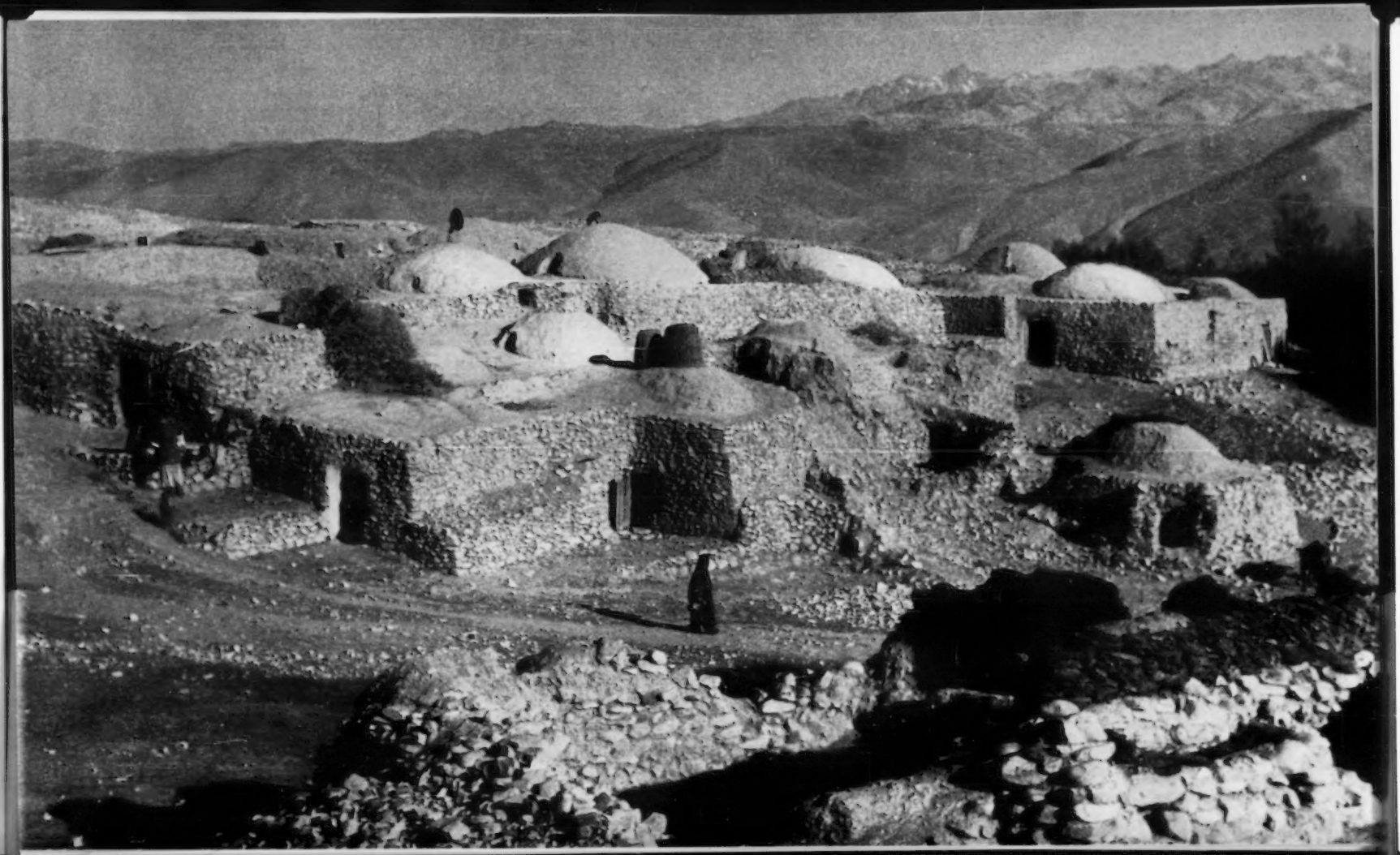
Wilfred Thesiger's route through the Hazarajat, central Afghanistan

Farmstead in Deh Zangi on the southern slopes of Kuh-i-Baba

Hazara mountain village with watchtower and domed roofs

Wedding party at a summer camp in Yakwalang, on the northern slopes of Kuh-i-Baba

Women of Deh Zangi weaving "barak" cloth on looms



pages on the Hazarajat, but many statements in this article seem to me to be inaccurate or misleading, and as yet nothing of importance has been written more recently to correct it. I travelled for six weeks in the more inaccessible corners of this district and lived among these tribesmen in their villages. I have therefore written this paper on their way of life and environment although I am fully conscious that my qualifications to do so are but slight.

The Hazaras are Mongols and inhabit a large area in Central Afghanistan. They were settled in this country in the thirteenth century either by Jagatai, Jinghis Khan's son, or by Mangu, his grandson, on the lands of the Ghoris, who had been largely exterminated during the Mongol invasion. They were put there to guard the marches, and it is therefore unlikely that they all belonged to the same tribe. It is more probable that they were the followers of chiefs, selected for their loyalty and that they represented many of the tribes and races incorporated in the Mongol army. Even today most of the Hazaras are unmistakably Mongol in appearance but they have abandoned the Mongol language and now speak a Persian dialect. As late as the reign of Babar they were reputed to speak Mongol and there are said still to be two or three villages near Herat whose inhabitants speak their original language. I was told by Mr. G. K. Dulling who has studied the Hazara dialect that 70 per cent. of their vocabulary is modern Persian, 10 per cent. is Mongol and 20 per cent. belongs to a language which he has been unable to identify. The Hazaras inhabit the Hazarajat which includes the western extremity of the Hindu Kush range and the broken country round the headwaters of the Helmand river. They extend northwards outside the Hazarajat towards the Uzbek country, westwards nearly to Herat, and southwards towards Ghazni and Kandahar. Estimates of their numbers vary greatly but it seems probable that in all there are about one million of them.

Kuh-i-Baba is the real heart of the Hazarajat. This high mountain range, of between 15,000 and 17,000 feet, runs from east to west for about 80 miles, and forms the western extremity of the Hindu Kush. It is separated from the wilder, more forbidding Paghman range by the Helmand river, which rises on the northern slopes of this range and then flows westward to the south of Kuh-i-Baba through the gap between these two mountains. To the south of the Helmand the Paghman range extends westwards beyond the Unai Kotal into the high broken country of Besud. Kuh-i-Baba is a dull mountain, a long and uninspiring range of generally uniform height, with few peaks, none of them of any size, and only a few small cliffs. Both sides of the mountain are seamed with a succession of valleys, and, although the sides of these valleys are usually steep, they consist mostly of earth or screes covered with thistles, coarse grass, hogweed, rhubarb and cushion plants. On its northern side the mountain falls very rapidly to low foothills which eventually merge into the plains. On this side of the mountain the valleys are short and water is scarce, whereas on the southern side the valleys are far longer and water is more abundant. From the top of Kuh-i-Baba one looks southwards across a series of smaller mountains to the Helmand river, and beyond this to the broken mountainous country of Besud. There is considerable variation in the flora on the two sides of the mountain; for instance, I saw much rhubarb and *polignium* on its southern slopes but none on its north side. Kuh-i-Baba consists of many types of rock, volcanic, plutonic, metamorphic, sedimentary and conglomerate, but these rocks are visible in the stream beds, rather than on the mountain slopes. The mountain is devoid of trees or bushes. I saw no juniper, indeed I did not see a single tree on this mountain, other than a few willows and the poplars cultivated

Hazara village in Deh Zangi, central Afghanistan

round the villages in the valley bottoms. There was a little tamarisk on the banks of the Helmand.

I had supposed that the Hazarajat was a desperately poor country and my first view from the slopes of Kuh-i-Baba confirmed this impression. I looked out across a succession of deep valleys, and over bare, stony, rolling hillsides, parched and tawny coloured. In the valley below me I could see a few patches of cultivation, green and especially noticeable in this empty landscape. But I soon realized that this impression of barrenness and desperate poverty, although a very natural impression, was a totally false one, due to the configuration of the ground. There are many springs on the mountain especially on its southern slopes, and streams in all the valleys. As I wandered through the country I discovered that almost every fold and wrinkle in the ground to which water could be conducted was cultivated. Walking up the valleys it often seemed that the cultivation would peter out round the next corner, and yet it would go on, sometimes widening out and sometimes narrowing, until eventually we came to the high valleys where all cultivation ceased. Even the hillsides above the villages were sown with rain-grown wheat (*lalma*). All ploughing was done with oxen, and it was surprising on what steep hillsides they had been used.

In some of these mountain valleys the houses are strung out along the hillsides above a narrow ribbon of cultivation, farm house succeeding to farm house throughout the day's march; in others they are grouped in small villages, one village perhaps separated from the next by miles of stony track. Here a dozen adjoining houses clung to the mountain side, there twenty or thirty houses were collected round a spring or on a convenient piece of level ground. Nowhere did I see any towns or even large villages. Panjao, the administrative centre of the Hazarajat, consists of a fort, a few Government buildings and a small bazaar. The tribesmen do not live in Panjao itself but on their farmsteads in the five adjacent valleys. Hazara houses are built of mud and stones, and most of them are very primitive, but their construction varies considerably in different places. Usually they consist of three or four rooms and a narrow dark passage-way. The rooms are nearly as dark as the passages since the few windows are very small and generally set high up in the walls, and let in little light even in the summer. An opening in the ceiling in the centre of the room lets out some of the smoke, but even so it is often difficult to see across a room when the fire is alight. These houses are built to keep out the cold which is intense during the winter months. Several houses often adjoin and share a common expanse of flat earthen roof; sometimes one roof covers the whole village. Where timber is available the roofs are supported on beams and the rooms are of reasonable size, but in many villages there are few if any poplars to supply these beams. The rooms are then small and each room is roofed with a dome built of stones. These domes rise up from the flat expanse of roof among stacks of straw, thistles, rhubarb leaves and other fodder, and heaps of Artemisia and various cushion plants collected, with piles of dry dung, for fuel. In most villages there are watch towers, built either in the village itself or on the surrounding hills to guard the approaches to the village. Not all Hazara houses are as primitive as this. The chiefs usually live in large well constructed forts, and in the most prosperous areas, such as the Kajao valley in Besud, many of the villagers inhabit similar buildings. These forts resemble those in the villages around Kabul, being rectangular in shape and built round a courtyard onto which the rooms look. Square or circular towers guard the outer corners of the fort, and the single entrance is shut with a strong wooden gate.

The Hazaras amongst whom I travelled were primarily agriculturists. They cultivate two types of bearded wheat—*gandum*, or irrigated wheat, and *lalma*, or rain-grown wheat. *Lalma* gives a better grain but a yield of only five to one, whereas *gandum* yields twenty to one on an average and sometimes as much as forty to one on good ground. They also cultivate much barley (*jau*) which is irrigated and gives a yield similar to *gandum*. All barley and *lalma* wheat and nearly all the *gandum* is sown in the spring. They were harvesting their wheat and barley during my journey and also the crops of peas and beans. These people grow some peas (*mushung*), lentils (*addis*), broad beans (*bakuli*) and chick vetch (*kalol*) as food for themselves, and bitter vetch (*shakhal*), lucerne (*rishqa*) and clover (*shabdar*) as fodder for their animals. They cultivate more lucerne than clover since a field of lucerne will yield four crops a year for twenty to thirty years, whereas clover only produces four crops for one year and then has to be resown. They thresh wheat, barley, peas, beans and lentils, and break up thistles for fodder, by treading them out with oxen. Few of them cultivate other vegetables, but I did occasionally see a few carrots (*zardak*), potatoes (*kachalu*), turnips (*shalgham*), marrows (*kadu*), cucumbers (*bodranj*), tomatoes (*badinjan rumi*), and onions (*piaz*) growing round their villages, and near the Helmand we managed to buy some sweet melons (*kharbuza*) and water melons (*tarbus*). I saw a few apple, mulberry and apricot trees in the valley of the Panjao but no walnut or almond trees. Maidan on the southern side of the Unai Kotal presents a striking contrast with the neighbouring Hazarajat. Here the valley bottom is thickly wooded with willows, poplars, plane trees (*chenar*), walnut and almond trees, as well as with orchards of apples, apricots and mulberry trees. Even the hill sides have a covering of bushes. I was told that the Hazaras in Shahristan grow much fruit but there was really no fruit in those parts of the Hazarajat which I visited. When I asked them why they did not grow fruit they answered "it is not our custom." In a few places they grow tobacco for chewing or for smoking in hubble-bubbles, but none of them smoke cigarettes. They also grow safflower (*maswar*), rape (*sharsham*) and another plant resembling rape (*turbak*) from which they extract oil for their lamps.

The Gazetteer of Afghanistan says that the food of the Hazaras principally consists of the flesh of their sheep, oxen and horses, with cheese and other products of their flocks; "grain is very scarce." This may well be true of some of the Hazara tribes, but those amongst whom I travelled fed chiefly on wheat or barley bread. They told me that if they are short of wheat or barley they grind up peas, broad beans and chick vetch, and if very short of food they even grind up the seeds of bitter vetch, after boiling them to remove the bitter taste, and add it to their flour. With bread they eat butter, curds, milk or butter milk. The Kuchis but not the Hazaras make cheese. Although the Hazaras are primarily agriculturists many of them own large flocks of sheep and goats, and some small, black, humped cattle. I was told that nearly all the *ghi* (clarified butter) that is sold in Kabul comes from the Hazarajat, and from the flocks of the Hazaras, and not from those of the nomad Pathan tribes, or Kuchis,[1] who camp in large numbers on these mountain tops during the summer. Hazaras, it seemed to me, seldom eat meat except during the ten days of Muharram which commemorate the death of Husain. During Muharram tens of thousands of sheep and goats are killed in the Hazarajat and their meat is cooked for lunch at the local mosques, where everyone—man, woman and child—assembles to listen to the sacred readings. In most Shia communities these readings take place in the evenings after dinner, but the Hazara, most of

[1] The Hazaras call these Kuchis "Afghans."

whom live in widely scattered farmsteads, collect at lunch time and disperse to their homes in the late afternoon. On several occasions I was hospitably received at these gatherings and given lunch inside the mosque. The Hazaras also kill any surplus sheep and goats in the autumn and dry their meat for the winter. They keep a few chickens and eat eggs. They drink tea, preferably green tea, generally without sugar, which is difficult to come by in these parts. In any case they only put sugar in the first cup, and none of them put salt in their tea as is the custom in Chitral and Gilgit.

During the winter the cold in these mountain villages is intense. Snow usually starts to fall in November and soon makes travel outside the villages almost impossible. Some snow was still lying on the mountain tops in September. The Hazaras sometimes travel on crude snow-shoes circular in shape, with two cross bars but without any netting, which they make from twisted willow saplings, but most of them remain in their villages until the spring. A few of them drive cattle, sheep and goats down to Kabul, where they fetch high prices at that time of year. Droving in winter can only be done along the main roads where there are caravan serais at short and regular intervals, and where the regular passage of these droves tends to keep the roads partly open. All the time which these people can spare from their cultivations during the summer and autumn is spent in collecting fuel and forage from the mountain sides to tide them through the long winter months. I was constantly surprised that such large communities could live throughout the winter at altitudes of 8,000–12,000 feet under these conditions. Not only are there no trees here but there are no scrub and no bushes. Their fuel consists of dried dung and various plants such as Artemisia and Acantholimon, Astragulus, Ainapodiaces, Anobrychis and *Atriplex moneta*. Such fuel is adequate, even if unsatisfactory, for purposes of cooking, but it can be of little value in warming a house unless burned in quantities which would be quite unprocurable. It is surprising that there is so little soil erosion in these mountains, where practically every kind of plant that grows is either grubbed up for fuel or cut for fodder. The population is admittedly not dense but it is widely distributed and is certainly high in comparison with similar mountainous areas which I have visited in Chitral and the Karakoram. Everywhere the mountain faces are scored with long vertical shutes, down which great bundles of fuel, collected on the mountain tops, are shot to the valley below. The Hazaras also collect large quantities of *Prangos pabularia*, rhubarb leaves, hogweed and many kinds of thistles for fodder. In the summer and autumn all the men and boys who can be spared from the fields set off soon after dawn and spend the entire day carrying great bundles of these plants down from the high valleys to their homes. Hogweed grows wild but is also cultivated in the valleys, usually at altitudes too high for wheat and barley. It is cut in the autumn, allowed to dry, then stacked, pressed down and roped into loads which are carried to the village. These plants are later broken up and fed to the animals, mixed with lucerne or clover. Everywhere that I went the men either carried loads on their own backs, or used donkeys, especially to carry the long poplar poles which they use for building. There are no mules in this country and the Hazaras own no camels, since it is too cold here for these animals in the winter. All the camels which I saw belonged to the Kuchis.

The Hazaras keep their animals inside their houses during the winter. When I was on the northern slopes of Kuh-i-Baba at the end of August it was already freezing hard at night, and the cows, sheep and goats were taken inside the houses. Four or five cows and some sixty sheep and goats would thrust their way through

the narrow doorway and disappear down a dark passage into the bowels of the house. During the day they were herded on the mountains by small boys to feed mostly on plants, not on grasses. The coarse grass (*Festuca sclerophylla*) which grows in scanty tufts in places on these mountains is useless as fodder, though it is sometimes collected as fuel. There is a little sward in some of the valley bottoms where a few chosen animals are grazed, but most of the land in the valleys is cultivated.

The Hazaras on the south side of the Kuh-i-Baba and in Besud remain throughout the year in their villages, but on the more arid northern slopes of Kuh-i-Baba they move with their flocks into summer camps known as *ailoq* high up on the mountain. In these camps they live in primitive circular stone shelters, roofed with a few shrubs laid over a framework of poles inclining inwards and upwards to a point. A few mats are sometimes thrown over these poles to give rather more shelter from the sun. In Surkh-o-Parsa the Hazaras move out of their houses in the autumn, after the crops have been gathered, and camp in the fields below. I was told that they camped in their fields so that their flocks and herds should manure them when they were brought in at night. By constantly moving their tents they are able to manure the greater part of their fields, these fields are small, the valleys on the northern slopes of the Paghman range being steep and narrow. These were the only Hazaras whom I met with who used black tents, like the Kuchis. In Surkh-o-Parsa I also saw a few small primitive *yurt*-like dwellings, made of mats fastened over a framework of willow saplings.

The Hazarajat is famous throughout Afghanistan for two of its products *ghi* and a special cloth called *barak*. The women weave this cloth on looms out in the open, and the men then soften it by placing it on a flat stone over a fire, and stamping on it for a whole day while they keep it continuously damp. They use this cloth for the mens' clothes and for blankets. Rugs (*gilim*) are woven but not treated over a fire. The Hazaras also make felt (*namad*) as floor coverings on which to sit or sleep. A Hazara man wears a long cotton shirt, and trousers, a coat, sometimes a waist-coat, and over everything a cloak or top coat. They all wear skull caps and generally a white turban tied so that one end falls down over the shoulder. A few old men wore lambskin caps and I was told that until recently this was the common Hazara head-dress. In Surkh-o-Parsa a few men and boys wore knitted woollen caps with tassels. The mens' dress today is drab, usually ragged and always unbecoming, unless it is copied from the Kuchis. Most men and boys wear charms sewn up in coloured cloth and stitched onto their coats or waistcoats. The women on the other hand wear gay clothes, generally red in colour, with many different types of head-dress according to the locality, and these head-dresses are often decorated with innumerable coins. Hazara women do not veil. I found them modest and even shy, and disagree entirely with the view expressed in the Gazetteer of Afghanistan that "The character of their women for unblushing immorality also appears to be universal; they are handsome and engaging and the opportunities offered, to strangers even, by some tribes are said to be most shameless." Broadfoot, however, says that the women are generally ugly and not very chaste but thinks that the custom of *kuri bistan* which consists of lending their wives to strangers for a night or a week is certainly a fabrication. I never came across it.

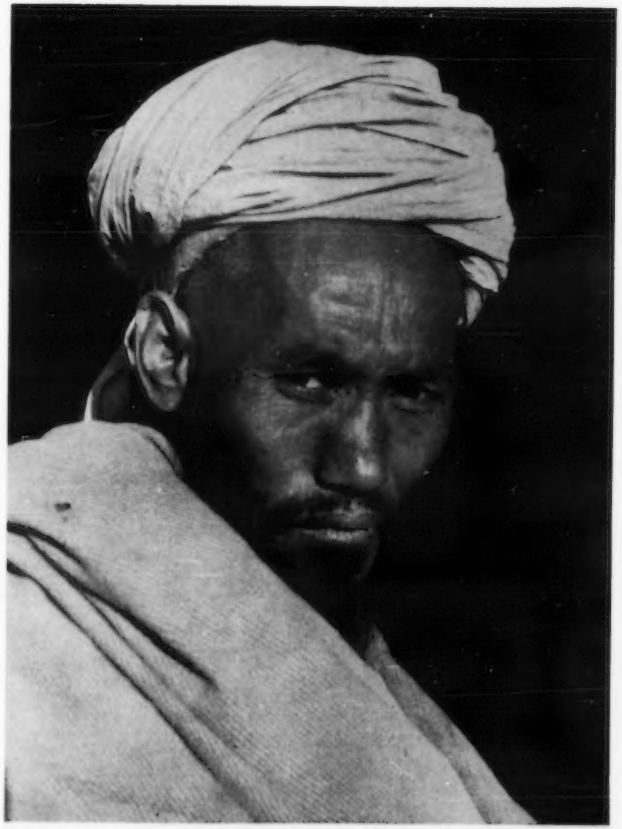
Nearly all the Hazaras are Shia Muslims, although a few of them in Surkh-o-Parsa belong to the Sunni sect,[1] Living among the Hazaras are a large number of

[1] On the other hand the Pathans, Uzbeks and Tajiks who surround the Hazaras are Sunnis and this religious difference isolates the Hazaras and exacerbates their relations with their neighbours.

Shia Sayids who claim descent from the Prophet and are often to be distinguished by their black turbans. In most villages there was at least one man, usually the richest man in the village, who had visited the shrines at Kerbala in Southern Iraq and was known as *kerbalai*. I was interested to find that a visit to Meshed al Ridha in north-eastern Persia conferred no title and little distinction. Among the Shia tribes of southern Iraq on the other hand a visit to Meshed entitled the pilgrim to call himself "zair," a much coveted distinction, whereas a visit to nearby Kerbala gave a man no right to distinguish himself from his fellows by any such prefix to his name. Few of the Hazaras I encountered had been on the pilgrimage to Mecca or Medina. I saw very few shrines in the Hazarajat; such shrines seemed to be more frequent among the neighbouring Sunni tribes. None of these Hazaras appeared to be the least fanatical and nowhere did I sense any hostility to me as a Christian.

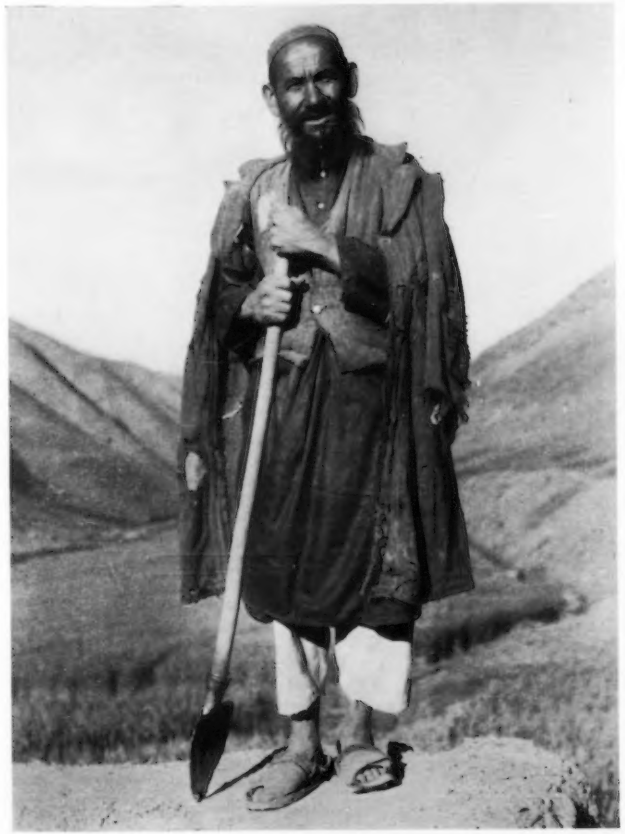
It is impossible to generalize about Hazaras since their way of life, their customs and even their appearance differ greatly in different localities. In Surkh-o-Parsa, for instance, the men are generally taller than other Hazaras and less Mongolian in appearance with heavy beards. It is also difficult to judge of a people whose language one cannot speak, but I was struck by certain aspects of the Hazara character. They are exceptionally honest: Connolly, it is true, describes them as unblushing beggars and thieves, but with this judgement I cannot agree. Theft among them is very rare and is universally detested. Although we generally slept on a roof, to avoid the bugs and fleas which infest the houses, we were never advised to guard our belongings, even where the roof was accessible to everyone in the village. It seems that the Hazaras just do not steal things, and in consequence they are much esteemed as servants in Kabul and elsewhere. They are also extremely industrious and obviously very hardy and they struck me as good farmers with an understanding and love for their land. On the other hand I found them almost invariably inhospitable, an unusual failing among Muslims. Nearly always, when we arrived in one of their villages and prepared to stop, someone would come forward and suggest that we should find very much better quarters in some other village a mile or two further on. They were never unfriendly, just mean and inhospitable. I found the Shia Sayids in the Hazarajat as inhospitable as the tribesmen, and yet towards the end of our journey when we travelled in the Maidan and in the Sanlakh valley, among Sunni Sayids and Tajiks, we met with a very different welcome. Time and again villagers pressed me to stop and drink tea, and towards evening many people working in the fields shouted out to us as we passed, inviting us to spend the night with them. Later in the Dara valley Pathan villagers were equally pressing with their offers of hospitality. Only among the Hazaras did we meet with this churlish inhospitality. We were not an impressive party, two of us travelling on foot with only one attendant, and for this reason our reception by this people was probably an accurate indication of their normal behaviour. Hazaras are fond of poetry, and I have been told that some of their poetry is really good, but I was surprised that these people, who spend six months a year cooped up in their villages neither danced nor played any musical instruments. I was told that in Shahristan the tribes dance and play music but none of the Hazaras amongst whom I travelled did so. They said that their amusements were horse racing, and shooting at a target from the saddle while at the gallop. The Gazetteer of Afghanistan (1882) estimates the Hazara cavalry in tens of thousands, but I saw only a dozen horses during my journey. At one large wedding the main feature of the day's entertainment was the horse racing, yet the assembled crowds could only produce five horses for the

Hazara boy wearing charms



Hazara of Deh Zangi

Hazara carrying fodder from the mountains



Farmer on southern slopes of Kuh-i-Baba

two races. I was left with the impression of a tough people, hardy, industrious and honest, but close-fisted, inhospitable and rather dreary. I found the Kuchis more welcoming, more amusing and far more colourful; the contrast between the farmer and the nomad. As usual, wherever cultivators and nomads meet, there is friction. In the Hazarajat large numbers of these nomad Pathans from the Ahmadzai, Mohmand and Safi tribes, travel up the valleys in the early summer to their grazing grounds on the mountain tops, and return again in the autumn on their way down to Pakistan. They have with them great numbers of camels, and large herds of sheep and goats. These Kuchis bring with them cloth, sugar, tea and other goods which they trade with the Hazaras for grain and flour. The Hazaras detest the Kuchis and the Kuchis despise the Hazaras, but it is obvious that the Hazaras are in no way overawed by these swashbuckling Pathans. On one occasion I was in a Hazara village when two Kuchis arrived with some camels loaded with grain to be ground at the local mill. Later the Kuchi who was herding the camels allowed them to stray into a field of wheat. The Hazara farmer drove out the camels and gave the Kuchi herdsman a severe thrashing with a heavy stick. The Kuchi never lifted a finger in self-defence, though he protested volubly.

There is little wild life in this country. I saw an occasional fox, one wild cat, a few hares and innumerable pikas or mouse hares (*Ochotona rufescens*). There are some ibex in these mountains. I saw a few pairs of their horns stuck in the walls of houses or laid outside shrines; all the heads were very small. I was told that there were urial in the foothills north of Kuh-i-Baba. There are a few brown bear on this mountain, and very occasionally panthers are seen in Yakwalang and the Paghman range. Although wolves are common they are seldom seen during the summer but in winter they collect round the villages and often become very bold.

As regards birds I saw a few large vultures, probably griffons, some Egyptian vultures, lammergeiers, buzzards, kestrels, ravens and many choughs, but only two pairs of peregrines. Magpies were very common and I also saw rock pigeons, rollers, Persian bee-eaters, hoopoes, snow finches, black redstarts, larks, red-tailed chats, wagtails, dippers, green sand pipers and one snipe. Chikor were very scarce; I only came upon one covey in six weeks. The Kuchis, however, catch a few of these birds and sell them in Kabul. I saw seven snow cock at about 14,000 feet on the Paghman range, where these magnificent birds, judging from the number of droppings, were not uncommon. We killed one snake near Panjao, the only one which we saw on this journey. Barbel-like fish are not uncommon in the larger streams and are caught and eaten by the Hazaras. There are enormous numbers of these fish *Schizothorax intermedius*?) in the three pools at Sar-i-Chashma, where the Kabul river rises, but the fish in these pools are protected by ancient custom, and none of them may be caught above a mill a little way downstream from the pools. Most of these fish weigh between half a pound and a pound. It is a strange experience to approach one of these pools. As you reach the water's edge, a solid, black wave of fish surges towards you in the hopes of food. If you throw any food into the pool it becomes at once a seething mass of fish so closely packed that the smaller ones are frequently thrust up out of the water. The fish are said to disappear completely from these pools for three months in the spring.

I am extremely grateful to the Afghan Government who gave me permission to make this journey and to Sir David Lascelles, the British Ambassador in Kabul, who obtained this permission for me, and put me up while I was in Kabul. The success of this journey was due very largely to the patience and tact of Jan Baz, under conditions which were always primitive and often exasperating. He was always cheerful, obliging and interesting, and his company was a constant pleasure.

FARMING PRACTICE, SETTLEMENT PATTERN AND POPULATION DENSITY IN SOUTH-EASTERN NIGERIA

W. B. MORGAN

IN 1951 A. T. Grove read a paper before the Society on the badly eroded country of Iboland in the Eastern Region of Nigeria.[1] In conclusion he pointed to the need for further research amongst the Ibo, particularly in the contrasting environments of the lowlands. The following paper represents an attempt to develop such research and is based on field work from the centres of Port Harcourt and Aba in 1954. The major part of the work is concerned with conditions in Aba Division, especially in that part of it termed Aba Ngwa County, whilst the study made in the area north of Port Harcourt, that is in Diobu District, is used to provide a comparison.

The farmer of south-eastern Nigeria is essentially a hoe cultivator; his work has the character of gardening rather than farming, since it is small scale and permits individual attention to the plants grown. Since holdings are small a large number of people per unit area is possible upon farmed land with resulting high rural densities. However, the chief problem of the south-east is that in many parts the population densities are very much higher than the present system of land holding would appear to allow. Grove has already shown the problem in the Awka-Orlu uplands and the Udi Plateau. South of these the lower and more level regions, stretching down to the deltas of the Niger and Cross rivers and to the lagoons and bars of the firmer ground between, appear to be divided into two density zones characterized by Aba Division with 347 to the square mile and Ahoada, which includes Diobu District, with 143 (Fig. 1). It was felt therefore that an investigation of the conditions around Aba and in the area adjacent to Port Harcourt might shed some light on density problems and in particular on the carrying capacities of the lands concerned.

The normal practice amongst the Ngwa and Ikwerri divisions of the Ibo-speaking peoples in Aba Division and Diobu District respectively is to plant their crops in two types of land—farm land, which is the major food producer, and compound land, which serves the purpose of a kitchen garden. Farmland is divided into holdings consisting of "farms" which may be further divided into plots. Generally, holdings average less than 3 acres per family plus another $\frac{1}{2}$ acre of compound land.[2] The cultivating unit is the family grouped into settlements whose pattern reflects the nature of the cultivation, since agriculture is the basis of existence. Here a contrast is immediately apparent amongst the Ngwa and Ikwerri. In Figure 2 it may be seen that the settlement pattern near Aba consists of scattered compounds entirely devoid of nucleation. The Ngwa in fact have no villages in the accepted sense. In Diobu, however, whilst compounds rather than individual huts are still characteristic, they are normally grouped together in well-defined villages of which that of Atako (Fig. 3) is an excellent example. The contrast in pattern appears to be related to a contrast in the form of local authority. Amongst the Ngwa, compounds are larger than those of the Ikwerri and house what may be described as an extended family or *onumara*—that is, not only a man and his wife or wives and children as represented by the *ezi* or smallest unit; but his sons, their wives and

their children and often brothers and cousins. Even within this unit of closely related families, each family undertakes its own farm work and, whilst some assistance may be given by one to another, the labour is in no sense communally performed.[3] Groups of compounds inhabited by kinsfolk together form a larger unit called a "village" or *mba* in which unrelated family groups may be permitted to settle if land is available. "Village" affairs are discussed at a common meeting place. The connecting paths or *ama* are thus of vital importance in such administrative system as exists, and furthermore link the compounds for trade purposes. Their importance is stressed by the common occurrence of the word *ama* in Ibo

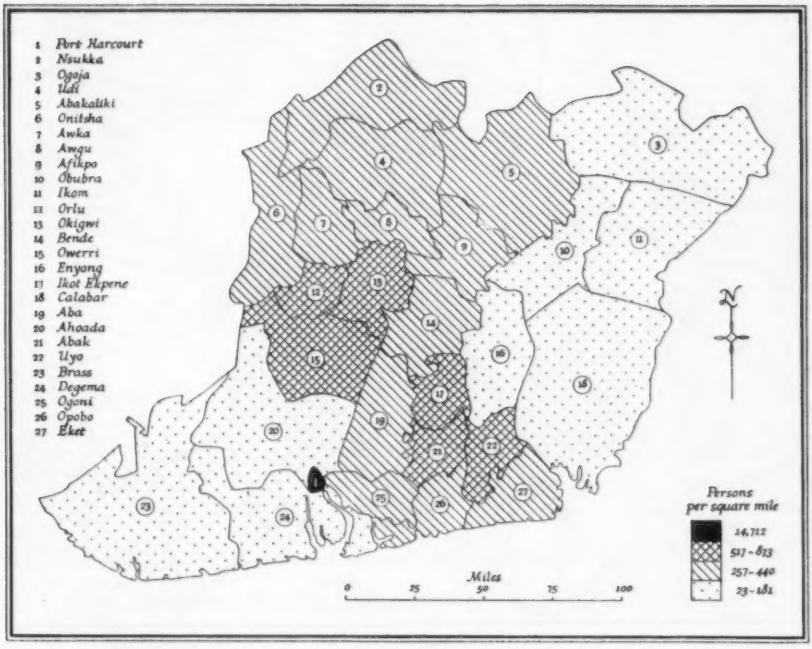


Fig. 1. Distribution of population by Divisions in the Eastern Region of Nigeria

settlement names[4] and, as will be shown, they have left an imprint on the agricultural pattern. The paths are vital also for water supply, since convenience with regard to agricultural land and not the location of water is the most important factor in determining the settlement site: this is so despite the scattered distribution of water, due to the porous nature of the sub-soil with its low dry season water-table, and despite the difficult descents to streams. Distances of 8 miles to water are not unknown. Each household provides itself with a clay-lined catch pit which, however, is usually too foul for drinking purposes. With the exception of location near local springs arising from the few laterite outcrops, Ngwa settlement tends to be away from streams with their steep valley slopes, steep high banks in the dry season and lack of flood-plain. This seems to be a common Nigerian phenomenon, for the chief concentrations of population are all on watersheds. Well-digging amongst the Ngwa was rare until the introduction of European techniques, owing

to the liability of collapse of excavations and the great depths needed. In Diobu, by contrast, whilst the village also tends to be a kinship group, it is in effect comparable to a gathering together of the scattered *onumara* of its Ngwa counterpart. Local authority is vested in a chief who appears to have a greater control over village and compound affairs, and many agricultural activities are performed on a

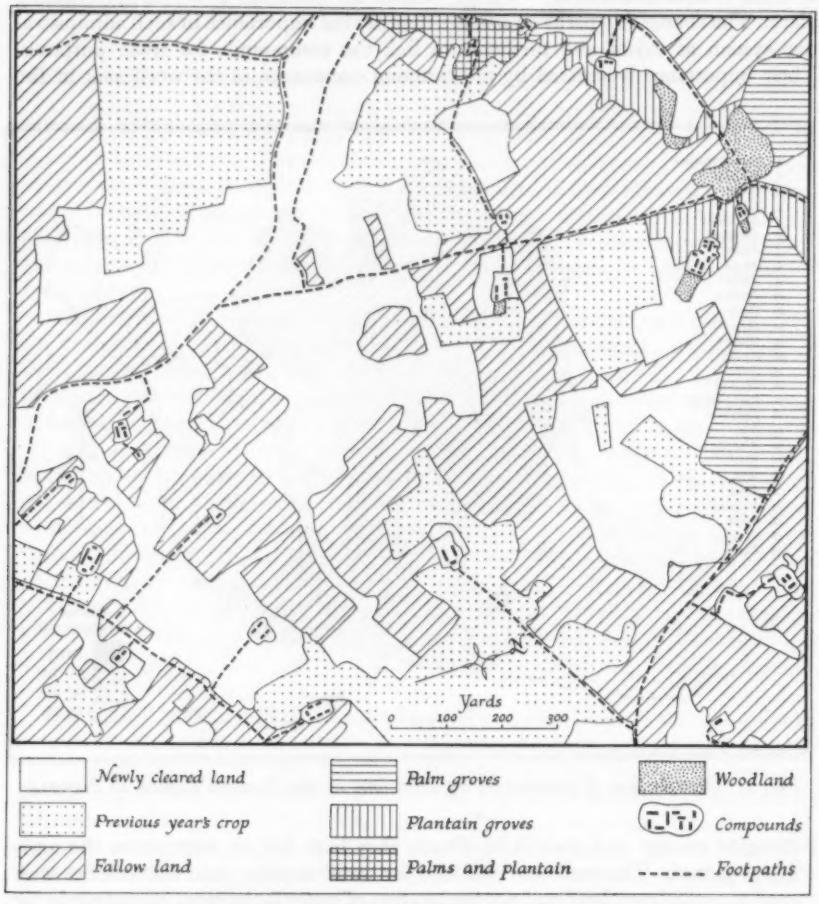


Fig. 2. Settlement and land use in Umu Ocham, Aba

communal rather than an individual basis. Here the paths no longer have as their main function the linking of compounds, but radiate out from the village to the "farms." In the Port Harcourt area the comparatively level surface of the older alluvia is much lower and the dry season level of the water-table is nearer the surface. The descent to streams is less than at Aba and waterside locations are common both for fishing and for trading purposes. Thus one has the surprising contrast of evenly dispersed settlement in a region of restricted water supply and highly localized, nucleated settlement in a region offering easier conditions.

The effect of village organization and settlement pattern on agricultural practice is immediately apparent from a comparison of the cultivated area depicted in Figure 2 with that depicted in Figure 4. The scattering of settlement in the Umu Ocham area of Aba Division is paralleled by that of the small blocks of cultivated land, whilst the nucleated settlement type of the Diobu area is accompanied by

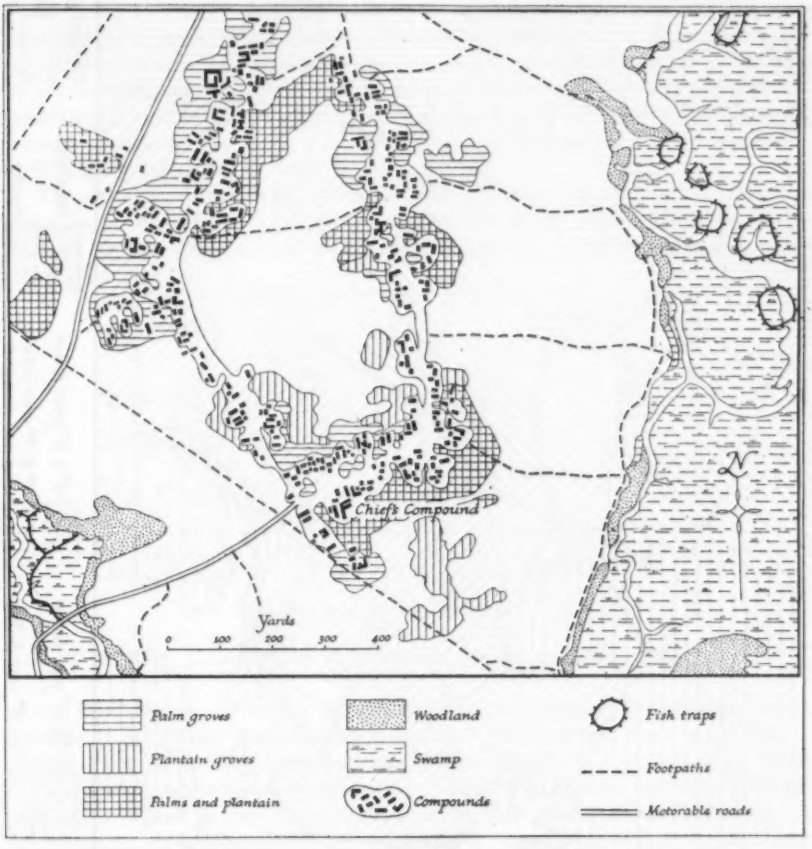


Fig. 3. Atako's Village, Diobu District

large cohesive blocks. Land utilization amongst both groups of Ibo is based broadly on six types of land:

1. The village or compound area with its accompanying kitchen garden land.
2. Farmland under cultivation and various stages of fallow, bearing oil palms in addition to annual crops.
3. Oil palm groves, usually close to the village or compound, and occasionally cropped.
4. Woodland, divided into (*a*) timber and firewood reserves including a windbreak round the settlement; (*b*) sacrosanct land, *i.e.* cemetery or religious

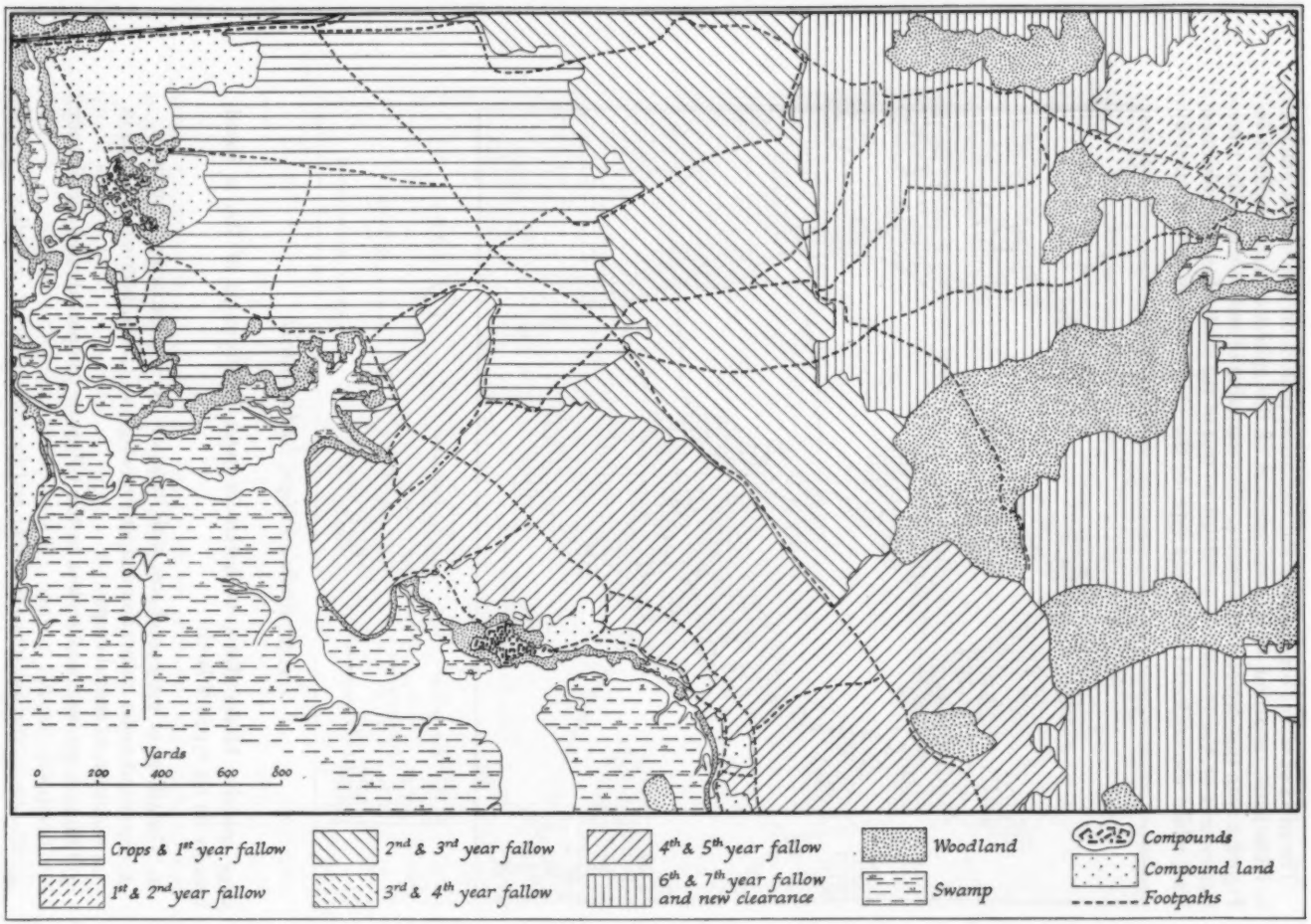


Fig. 4. Settlement and land use in eastern Diobu

shrines; (*c*) boundary demarcation lots, of which there is a good example in the northern-eastern quarter of Figure 4.

5. Plantations, generally of oil palms, a recent innovation due to European influence.
6. Wasteland, including swamp, steep slopes and areas of infertile soils.

Of this classification farm land clearly occupies the greater part of both areas depicted, with most of it in fallow. The fallow period in Umu Ocham generally lasts three years, and in eastern Diobu six to seven years. Only a small proportion of the farmed land is therefore productive in any one year. The confusion of fallow and farmed land in Umu Ocham illustrates the effect of farming from a variety of centres and this confusion is made worse by the development of land ownership and fragmentation due to inheritance.

The greater part of the area shown in Figure 4, illustrating conditions in February 1951, is farmed from the village in the north-western corner whose limits are marked by the woodland belt stretching with small breaks eastwards in a broad

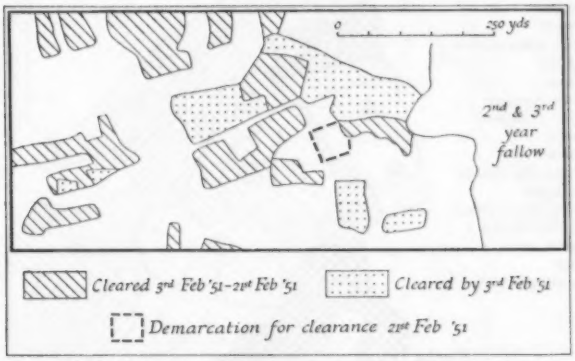


Fig. 5. Sample 18-day clearance pattern in eastern Diobu

curve from Amadi. In Amadi village farming is restricted to the narrow riverain stretch of compound land since its people are Okrika whose main occupation is fishing. The outstanding feature of the farmland is the division into large blocks each representing two years of cultivation. The normal practice is to clear scattered patches in fallow of the sixth and seventh years. Figure 5 shows the haphazard arrangement over an eighteen-day period in February 1951. Community needs take up approximately half the area available. Since, however, there is insufficient land to continue the process of scattered clearance indefinitely, the remainder of the block must be cleared the following year and the chief and elders must advise on the equitable division of the land. Thus the pattern of cultivation pursued is one combining random clearance with the thoroughness needed by a people who must cultivate all the land locally available. The remaining blocks, therefore, consist of various two-year stages of fallow, plus a block having the previous year's planting of cassava and the first year of fallow weeds and bushes. But in Umu Ocham (Figure 2, depicting March conditions) only small patches of community land exist, the greater part being privately held by each compound. Private or *okpulo* land as opposed to community or *egbelu* land has always been regarded as that to which an individual or family has a possessory title comparable to that of an

absolute freeholder except that it cannot be permanently alienated.[5] Land may be pledged indefinitely for a loan, but it can always be redeemed without compensation for any improvements affected. With increasing shortage of land there has been a tendency for individuals to acquire private holdings in order to ensure a sufficient share of the area available. Custom has tended to weaken so that pledging is often virtually a sale. In addition a system of renting has developed. Community land is

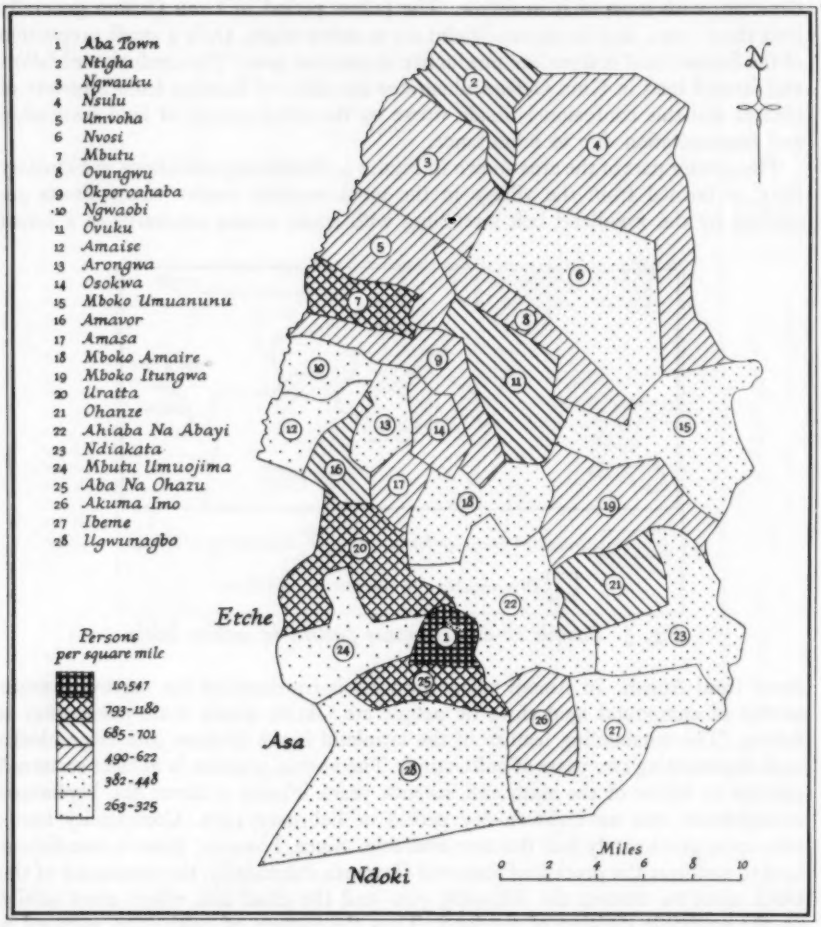


Fig. 6. Distribution of population by Local Council areas in Aba Nwa County

still divided by the decision of the elders, but scattered clearance is impossible since the blocks available are so small. Moreover, fragmentation due to division amongst heirs is reducing the size of holdings and of individual blocks still further. Although the figures are not available to provide a detailed comparison there is every indication that population density is higher in Umu Ocham than in Diobu and is partly responsible for the contrast in agricultural patterns.

Figures for population density, areas of holdings and periods of fallow are difficult to obtain and of doubtful value. Nevertheless the subject is important enough to warrant the study of such material in order to obtain at least an indication of the nature of the situation. Figure 6 shows the distribution of population by Local Council areas in Aba Ngwa County. There are two main regions of high density: (i) the north with 931 to the square mile in Mbutu, and 685 in Ntigha and Ovukwu; (ii) Aba district with 1180 in Aba na Ohazu, 793 in Uratta and 701 in Amavor. The extremely high densities to the north-west and south of Aba are partly due to urban growth under European influence and the development locally of "market gardening." Generally the two main population regions are favourable

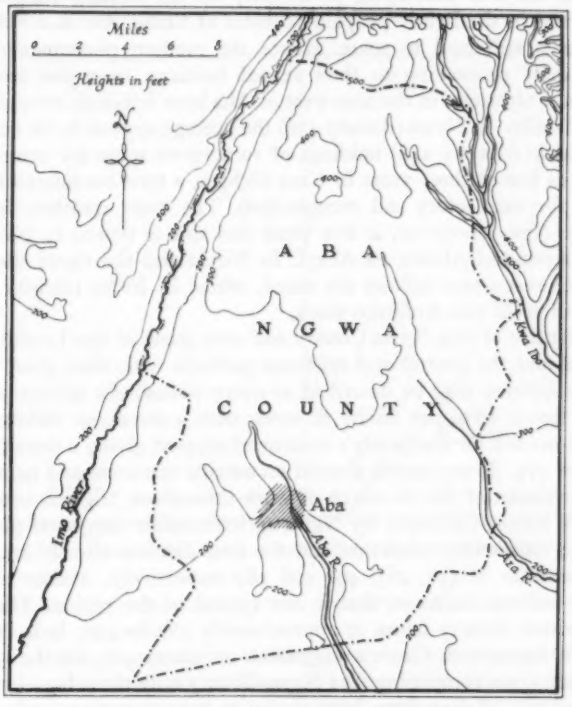


Fig. 7. Relief and drainage of Aba District

to Ibo farmers since they are abundantly provided with the light, sandy brown earths which are preferred for farmland and for the growth of oil palms. Towards the south with lower altitude and slightly heavier rain these earths tend to become more acid. Moreover, the surface of the country becomes more highly accidented (Fig. 7). It is the steep slopes of the valley of the Aba river which are primarily responsible for the comparatively low density of Ahiaba na Abayi. Occasionally very sandy and useless patches of soil occur bearing only spear grass as in Amaise and Ngwaobi. However, a large part of the explanation of the various densities of population may be found in the historical evidence. According to reports compiled by District Officers,[6] the Ngwa entered the region from the north-west making their founder settlement in Ngwauku and driving back the former Ibeme and mixed

Ibo and Ibeme inhabitants. Other invasions of the north followed, and as these first settlements developed and more land was sought, numerous "colonial" villages, each taking the name of the parent settlement, were founded to the south and east. The Mboko district in the east was never overrun by the Ngwa, which may explain the lower density figures recorded by the three Mboko Local Council areas. The population density of the southern area and of the Etché, Asa and Ndoki groups was reduced by a slave raiding for the merchants of Bonny and Opobo. British rule has not only brought slavery to an end, but has tended to prevent further Ngwa migration, resulting today in numerous land disputes particularly on the eastern border of the Ngwa against the Ibibio. The practice of renting land has also developed, particularly on the western fringes of Mbutu Umuojima and in the lightly peopled portions of Etche, Asa and Ndoki districts where there is still land to spare. Hence the modern phenomenon of bicycle cultivators daily proceeding to their rented holdings from the crowded lands around Aba. Cultivators in the area west of Aba have holdings averaging less than 3 acres per family. In Nvosi (density 436) the average appears to be nearer 4 acres, whilst in Ndoki (density 148) holdings of 10 acres or more are common. Fallow periods are as low as three years in Umu Ocham, a time considered locally to be insufficient for satisfactory soil recuperation. The most common fallow period amongst the Ngwa, however, is five years and this is typical in Nvosi, Amaise, Mboko Itungwa and Ahiaba na Abayi. In Ndoki and the Ogwe district of Asa (density 306) seven-year fallows are usual, whilst in Etche (density 187) fallow periods are often of nine to fifteen years.

All the districts of Aba Ngwa County and even parts of Asa Local Council area are crowded and the central and northern portions with their short fallows and temporary migration may be described as overcrowded. An approximate calculation shows that 3 acres per family of seven with a three-year fallow means that 12 acres are needed for the family's continued support giving a density on farmed land alone of 373. Many people depend on outside resources and here one should note the movement of Ibo in search of work throughout Nigeria, many of whom remit money home. Comment by Ngwa agriculturalists suggested that five years fallow is the satisfactory minimum and the four districts already known to have this have densities of 436, 263, 490 and 382 respectively. Amaise with 263 has exceptional soil conditions so that is not typical of the region. The remainder suggest a critical density figure at approximately 382 to 490. It is interesting to compare this figure with Grove's suggestion of 300 to 400. Of the twenty-seven Local Council areas comprising Aba Ngwa County only three have lower densities than 382 and two of these have been shown to have exceptional adverse physical conditions. If Aba Ngwa County is a fair example of the lands immediately south of the Awka-Orlu highlands then there is no room here for immigration from the badly eroded parts of the latter.

One result of crowding is the development of rectilinear plot patterns, although even in areas with plentiful land there is occasionally a rectilinear tendency due to attempts to economize in the work of clearing fallow. Figure 8 shows examples from both Umu Ocham and eastern Diobu. The narrow plot frontages combined with great length indicate the importance of access to paths. Paths are often arranged in rectangular patterns at even distances apart, thus enabling easy measurement of newly cleared land by mere pacing of plot frontages for the purpose of division. One area was found to be cut by parallel paths a little over 200 yards apart. Each plot was thus 100 yards long and had approximately 9 yards of frontage giving an area of approximately one-fifth of an acre. Even on community land the

scattered patches to be expected from the fragmentation of private holdings is prevalent. The distances apart of both community and private farms may be as much as 5 miles: a problem of dispersal offering serious difficulty to the introduction of European concepts of farming. The size of the plots into which the farms are divided varies. Calculation from aerial photographs and pacing in the field shows that of 75 plots in Umu Ocham the largest was 0·44 acres and the smallest was 0·07 with a mean of 0·25. In eastern Diobu, of thirty-eight plots the largest was 1·35 acres and the smallest 0·12 with a mean of 0·35. The district with the larger plots also has longer fallow periods and a lower population density.[7] With increase in the area of private land a degree of permanence in plot shape is beginning to emerge, for many of the plots near Aba have presumably reached the minimum useful size. This permanence is reflected in the common occurrence of fencing on both farm

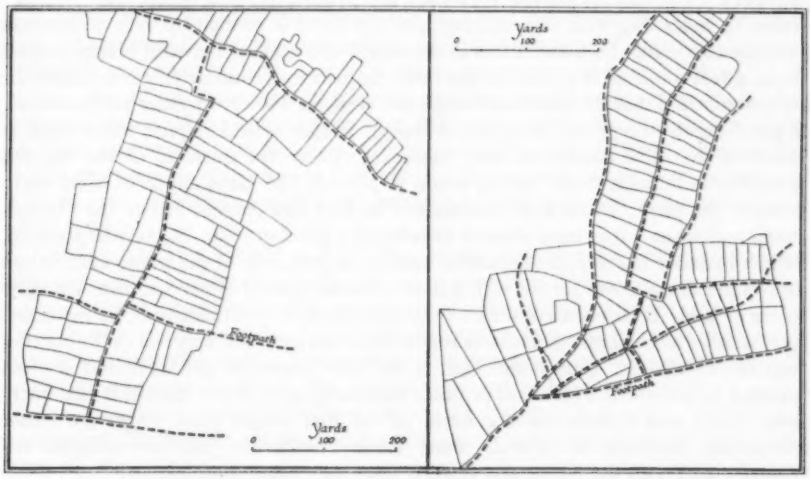


Fig. 8. Plot patterns in (left) eastern Diobu and (right) Umu Ocham

and compound land in order to protect the crops from the depredations of goats, sheep, cattle, pigs and fowls.

Crowding has brought with it the problems attached to fixing a system originally dependent on regular movement. Villages and compounds now occupy almost permanent sites. Cultivation similarly is restricted to rotation over a fixed area instead of a widespread "shifting" throughout the bush. This tendency to permanence has been encouraged by the development of a modern administrative system combined with fixed trading centres and routes. In the south of Aba Division, for example, artificial village councils or groups had to be formed in order to obtain "a workable administrative system,"[8] thus introducing a new rigidity to the old social order. Fixed paths and compound spaces have resulted in gullying. Hut foundations are often exposed and village churches and compounds undermined. Reduction in fallow period must lead eventually to lower returns per acre and possibly accelerated soil erosion. Fixed compounds must also mean fixed disposal of human excrement with a consequent danger to health. Present practice is to make cesspits on compound land which is also heaped with household refuse often making cultivation on such land possible without a fallow period. Manuring in this way is developed to the extent of heaping refuse around the trees, particularly palms and fruit trees, thus

providing compound land with the richest "black" soil. In the past, plots near living quarters have become overgrown and the occupiers have been forced to move.[9]

Changing circumstances may demand changes in agricultural technique, but all suggestions for improvement must face the fact that Ibo farming practice is careful and based on long experience and that the environmental conditions offer limitations unknown to Europeans. Generally amongst the Ngwa and Ikwerri the men plant and tend those crops and trees needing most attention, leaving the remaining food production to the women. Thus men's crops include yams, pineapples, oil and raffia palms, coconut palms, plantains and bananas, and oranges, African pear, kola, oil bean and "vegetable leaf" trees. Women's crops are cassava, maize, cocoyams, beans, groundnuts, pumpkins, calabash, melons, okra, chillies and peppers. After careful storage seed yams are planted in April before the "former" rains, in holes dug with a special hoe, and the earth is heaped up to form mounds usually over 1 foot high and 2 feet in diameter—the spacing between plants varying from 2 feet 6 inches to 5 feet. It has been claimed that contour ridges are superior to mounds and that the latter encourage soil erosion. However, yams need aeration, a good depth of soil and adequate drainage. Ridges would require more work to produce the same conditions and, moreover, where the quantity of the top soil available is limited, could not be made to provide the same depth of tilled earth around the plant. Cassava is interplanted in July and August before the "latter" rains and when yams have already developed a good growth. Such interplanting, which includes maize and vegetables, usually in part only of the plots, ensures not only a protective cover for the soil, but an extended period of harvest from the same piece of land. It also confers some of the benefits of crop rotation and, by including plants of variable needs, guarantees that at least one crop will succeed in the varying weather conditions. Compound land is the chief vegetable producer and is often planted to cocoyams which will produce some crop even if the rainfall is extremely low. Yams and cassava are the bases of the diet whilst other crops are either flavouring elements or provide some variety. Soils are carefully selected for planting and both the Ngwa and Ikwerri have their own classification.

The distinction of soil types and the recognition of the value of manuring are both evidence of careful farming. The few animals kept are allowed to graze on the fallow. Of these only goats and sheep appear to thrive. Cattle are of the dwarf trypanosomiasis-resistant variety, poor in both meat and milk yields. Grass fallows might provide increased and better quality fodder, but would entail considerable work in the suppression of encroaching shrubs and would not give the great volume of vegetable matter considered essential by the Ibo for burning before resuming cultivation. Burning supplies nutrition to the soil in the form of ash and reduces the number of insect pests. Small plots make possible individual attention to plants thus maintaining within the limits of the technique a high production per acre. Suggestions for farming on a larger scale must face the possibility of reduced production per acre in an overcrowded land. Fewer plot boundaries and the introduction of ploughlands would threaten the soil with rapid erosion from heavy showers. At Aba on 10 July 1950, 2·3 inches were recorded and on September 10, 2·8 inches. The following year 2·4 inches fell on May 5, 3·2 inches on September 2 and 3·0 inches on October 10. Occasionally rainfall totals differ considerably from normal. Whereas in 1933 106·2 inches were recorded, in 1950 there were only 60·5 inches. Concentration of the total likewise varies. The 1950 total fell in ninety-eight rainy days, *i.e.* days with more than 0·01 inches, whilst in 1947 94·0 inches fell in eighty-five rainy days.[10] The heavy rains of 1955 resulted in the presence of unusually

large numbers of insect pests at the time of planting, whilst the delayed rains of 1945 set back the maize crop and reduced the size of the yams. Two years later hot weather combined with heavier rainfall gave good returns of cassava and cocoyams, but maize again declined and so did vegetables. The 1952 fall, the heaviest for five years, gave good yams and early maize, but fostered rust amongst many late crops.

Despite the restrictions imposed by physical conditions and despite a conservative outlook, Ibo farmers are gradually changing their methods in response, firstly to changing social and economic circumstances, and secondly to the influence of Government Departments, particularly the Department of Agriculture. The expansion of trade has offered improved markets for palm products, the export of which from Aba Division has increased with fluctuations to a 1952 total of 39,427 tons of oil and 21,523 tons of kernels. The oil palm is the most valuable asset of the Ibo farmer since it is not only a source of cash, but provides food (in the form of fats which would otherwise be lacking with the shortage of animals), building materials and, together with the raffia palm, the staple alcoholic drink of "palm wine." Before the present large scale development of the palm oil trade, planted palms or palms on compound land were privately owned. Since the introduction of direct taxation in 1928, however, all palms must be open to fruit cutting by the whole community, generally for a period of three months in the year, in order to give everyone a means of paying tax, and thus inhibiting the establishment of palm plantations.

Cassava, and to a limited extent yams, copra, fruit and wild rubber have also become sources of cash. Cultivation of cassava has been encouraged by rising food prices with the increase in the proportion of non-agricultural population. Yams have become a rich man's food, but with the greater labour involved in their cultivation it is generally reckoned that more money may be obtained from the growth of the cheaper cassava sold in Aba Township or sent in the form of flour or *gari* to Port Harcourt and Calabar Province. The trade formerly depended chiefly on the markets of Enugu and Onitsha and was stimulated during the war by a "plant more cassava" campaign. Since the war, however, these markets have found cheaper sources of supply. The export of food from the Aba Division is balanced by the import of yams, cocoyams, fruit, fish and meat from surrounding districts. The *gari* trade has resulted in the expansion of cassava growing at the expense of yams. Other factors have also contributed to an apparent decline in yam cultivation. Firstly, whilst women are keen traders and spend a proportion of their time away from the farms, men also are taking an increasing interest in trade and in transportation by bicycle competing with motor lorry traffic. In addition many men seek employment as labourers or clerks whilst others have probably had their attention drawn from farming by military service. There has been therefore a decreasing interest in farming amongst men, which has led to a decline in the production of the chief men's crop—yams. Both men and women are on the whole devoting less time to farming and therefore tending to concentrate more on cassava since it is the easiest crop to plant and tend. Moreover, cassava has become a cheap, easily transported food of increasing popularity amongst the major part of the employed population, has the advantage of harvest in May and June when no other fresh food is available, and is generally more productive on land with short fallows.

With regard to the cheapening of goods and the improvement of market facilities by trade the introduction of tarred road surfaces and the opening of the railway from Port Harcourt to Enugu in 1916 have had obvious effects. However, the old river routes of the Imo and Aba still compete via Opobo for palm oil traffic and are

the chief means of conveying building sand and gravel. The improved facilities for export have also brought imported goods particularly cloth, metal ware, stockfish, kerosene, salt and soap. The old weaving and metal industries and the salt trade have declined. The increasing dependence on overseas markets has also made the Ibo farmers subject to world price fluctuations and wartime shortages.

Attempts directly to modify agricultural and related social conditions came firstly with the suppression of slave raiding, which dated from the establishment of the first consular post at Obegu in Ngwa territory in 1895 and from the Aro Expedition of 1901–2. This was followed by the acquisition of land by urban authorities, missionary societies and the Forestry Department. Although these acquisitions are small compared with the whole, nevertheless the local problems they have created have been sufficient for many Ngwa and Ikwerri farmers to place the blame for overcrowding on the authorities concerned. In Diobu compensation claims and litigation have persisted since 1913 when the chiefs sold a large part of their land to the Government for the development of Port Harcourt. Direct interest in the agriculture of Aba Division began with experiments to improve the oil palm by the establishment in 1927 of 27 acres of experimental palm plots. In 1928 Regulation 20 enforced grading and inspection by Government agents of palm oil and kernels. The Agricultural Department followed with the issue of palm seedlings to farmers and, despite the difficulties incurred by communal culting, the encouragement of palm plantations; this was combined with the introduction of hand-operated oil presses. Experiments have been made to improve kola nut production and the growing of fruit, particularly oranges, has been fostered. During the war rubber planting and tapping boomed and the Department extended its interest to food in addition to commercial crops. This interest developed into an attempt to modify the entire agricultural system. In 1945 and 1946 an economic survey by individual sample villages was undertaken whilst a policy of all-round improvement in agricultural technique was laid down in Sessional Paper No. 16 of 1946 and confirmed by the Agricultural Ordinance No. 37 of 1948. In 1946 lime was issued to farmers and the construction of palm-oil mills began at Owerrinta and Azumini. There was a fear locally that the building of mills meant that the Government was going to take over the palm trees. Further post-war schemes include trials of fallow plants, of Chinese yams and rice, experiments with lime and artificial fertilizers and the establishment of Demonstration Farm Centres, Nurseries and Experimental and Demonstration Plots. The well-digging programme which had been commenced before the war was intensified. Pioneer Oil Mills proposed to establish a network of mills throughout Aba Division each sited 8–10 miles from one another. This plan has been followed despite demonstrations against mill construction and opposition to the Agricultural Bill. In 1951 five mills were in production and four more building, artificial fertilizer was distributed to farmers and approximately 10,000 palm seedlings and 951 fruit trees planted, the latter encouraged by the construction of a fruit juice factory at Umuahia. Furthermore, loans were given for the establishment of plantations of oil palms and rubber, and of poultry, sheep, and pig farms.

South-eastern Nigeria faces, in regions like Aba Ngwa County, a problem of overcrowding. On the southern fringes, in regions like Ahoada, there is still land available for migrant farmers, although even this is evidently being reduced. Moreover, any attempt at a general resettlement would involve social disruption since all available farm land in the latter appears to be occupied, although farmed on more extensive lines. Farmers like the Ngwa have reacted to their new conditions by migration, by the fixing of settlement and associated farmland, by the

reduction of farm size and fallow period, by changes in cropping and land tenure and even by the introduction of rules governing harvesting. The influence of world markets and the need felt to improve agricultural technique has prompted Governmental attempts to introduce further modifications, abandoning in effect the old policy of Indirect Rule. Whilst it is true that rapid changes are disrupting the old institutions and introducing new problems which Government authorities can do much to solve, it is also evident that too rapid a promotion of new policies can also produce chaos. Similarly whilst the criticism can be raised that many more improvements are needed—for example, the planting of grass in all compound spaces around buildings could do much to prevent gully erosion—it is again evident that there is a danger in undertaking new methods of not fully appreciating the milieu or the results. Every improvement in agricultural technique and every increase in capital expenditure will tend to fix cultivators more and more to certain holdings. Whilst it has been shown that the amount of movement required for farming is decreasing, it would be unwise to push the process too far by proposals involving increased expenditure on the land, until the questions raised by fixed agriculture in inter-tropical conditions have been answered.

Acknowledgments

The author wishes to acknowledge the help received from District Officers, Officers of the Agricultural Department and the many Ibo cultivators interviewed in the areas concerned, and also the loan of aerial photographs by the Nigerian Survey Department.

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GENERAL ATMOSPHERIC CIRCULATION AND WEATHER VARIATIONS IN THE ANTARCTIC

H. H. LAMB AND COMMANDER G. P. BRITTON, R.N.

FOR MANY YEARS meteorologists, influenced by Hobbs's theory [1, 2] * of a permanent glacial anticyclone, and piecing together fragmentary data, built up a rather static model of a balanced circulation of the atmosphere over Antarctica. The two main facets of this model were a permanent anticyclone at the lower levels, with net outflow of winds across the isobars, and above it an upper cyclone (the circumpolar vortex) with net in-blowing wind components. The upper and lower systems were supposedly linked by a more or less permanent condition of subsidence over the ice cap and drainage of a skin of cold air down its slopes. The picture has a certain statistical validity, but may be grossly misleading if taken to imply a steady state.

To be sure, it was allowed that the system showed variations of intensity. Simpson [3] found apparent surges of high pressure starting from a point near 80° S., 120° W., which he supposed radiated outwards, in the manner of the strophs of Hobbs's permanent glacial anticyclone. Other writers, notably Meinardus [4] and Kidson,[5] remarked on the extraordinary magnitude of the extreme pressure variations at Antarctic stations and suggested that the coastal fringe was often under cyclonic influence from the depression belt of sub-Antarctic latitudes. More recently it has been realized that there are times when the pressures are so low that no anticyclone can be present at all [6, 7, 8].

It is the purpose of this paper to focus attention upon the observed variations and to attempt a reassessment of the occurrence of anticyclones and depressions in and around Antarctica and their interpretation in terms of wind and weather.

The concept of permanence of the Antarctic anticyclone was encouraged by the remarkable constancy of surface wind direction at certain expedition bases on the coast of East Antarctica.† At Mawson's Terre Adélie base [5] at Cape Denison in Commonwealth Bay (67° S. 143° E.) over nearly two years (1912–14), 95 per cent. of the winds recorded were southerly or south-easterly, whilst on the Shackleton Ice Shelf (66° S. 95° E.)[9] the month of September 1912 yielded 91·5 per cent. ESE. winds and not one observation of a wind from E. or S.E.—a knife-edge precision of the preferred direction! The southerly blizzards at Commonwealth Bay (mean annual wind strength 38 knots) blew out to sea almost at right angles to the coastline, suggesting some rather local modification of the strongly predominant

* See numbered references at end of paper.

† For the sake of brevity in describing the distributions of atmospheric patterns and meteorological phenomena in this text, it is convenient to use the (still tentative) names "East Antarctica" and "West Antarctica" to refer to the two main natural divisions of the continent. A map is given in Figure 1 to show the positions of these and other important names.

Portions of the 1000-metre contour are also delineated on this map, and will serve as a reminder of the supposedly general high level of the interior of Antarctica: the Polar Plateau ranges from 2500 to 3000 metres above sea level and mountains rising to over 4000 metres are known. This very mountainous character of the continent distinguishes it as much from other continents as does its ice-covered surface.

The nearest parallels are with Greenland and central Asia, though there is still a possibility of some extensive lowlands in Antarctica.

SE. winds of Terre Adélie. The ESE. winds prevailing on the Shackleton Ice Shelf appear more typical of the coast of East Antarctica in that their direction was more or less parallel to the coast. The whaling ship *Balaena*, operating from 25 to over 100 miles from the coast in 1947 between 110° and 115° E., experienced 75 per cent. south-easterly and easterly winds blowing parallel to the general line of the coast (65 per cent. actually between SE. and E.) during a period of 19 consecutive days (74 observations). Nevertheless, this predominance of one direction is not at all

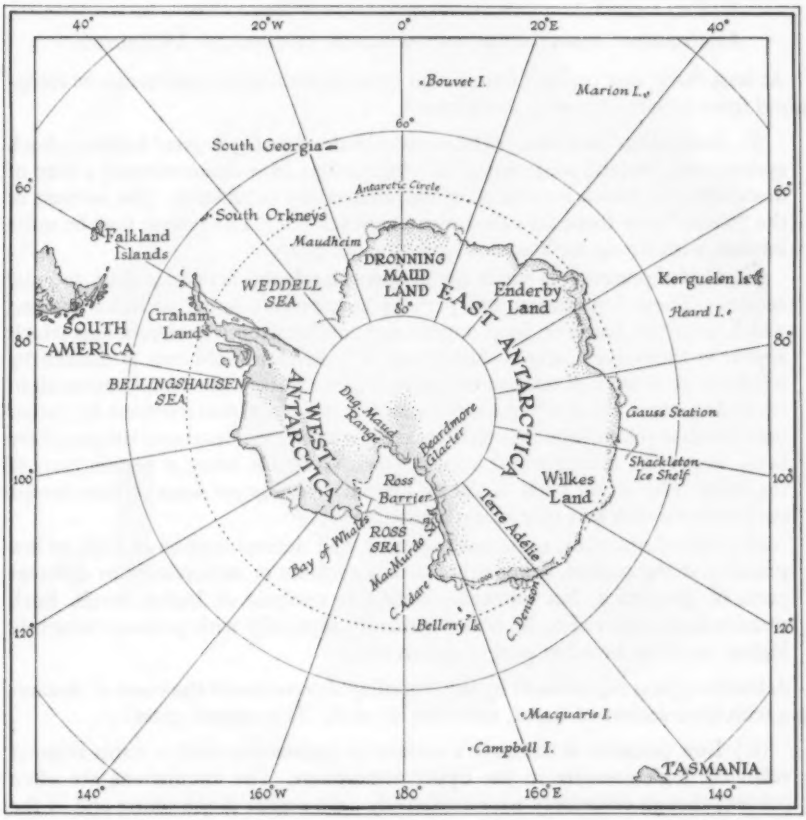

Figure 1

times equally pronounced, and the Shackleton Ice Shelf station actually reported 18·2 per cent. westerly winds (6 per cent. SW., 12 per cent. W.) in December 1912, 16·1 per cent. in January 1913 and 10·8 per cent. in May 1912, against 1·1 per cent. in September and no single observation of a westerly wind in April 1912.

From the occurrence of westerly winds in this area at and near the coast, we may conclude that cyclonic situations occur over East Antarctica perhaps 5 to 15 per cent. of the time. There is a considerable variation of frequency in different years, owing to the tendency for apparently random occurrence of long spells of one or another type of situation. Such reversals of type of circulation must be important

for the precipitation they bring and because of the possibly surprising changes of wind and weather in a region where surprise spells hazard.

During recent years many workers in various countries, including both the present authors, have been engaged in attempts at analysing daily weather maps for most, or all, of the southern hemisphere. Experience of the daily maps has more and more led to the view that compensation and balanced exchanges of air between different latitudes in the far south, as elsewhere, are the end-product of a sequence of changing situations.

Atmospheric circulation and weather systems in Antarctica

At least three, and perhaps four, broad types of circulation system can be recognized from time to time over Antarctica [6, 11]:

(i) *Anticyclones with anticyclonic circulation developed up to great heights.*—Such systems require (and some upper air observations have demonstrated) a core of descending air which is to some extent warmed by subsidence. (On account of the "warm" core these are called warm anticyclones.) The system may be quite intense, with strong surface winds near the periphery.

(ii) *Cold depressions in which the cyclonic circulation is developed up to great heights.*—These depressions may perhaps include both large, occluded systems which enter the Antarctic from outside and smaller, frontless circulations which appear at times over parts of Antarctica. The essential cold core is marked by relatively great lapse of temperature with height and very low temperatures aloft. Over Antarctica these systems appear to be generally characterized by rather light winds at the surface, though there may be strong winds around the periphery in the upper air. Strong winds from between W. and S. occur at certain parts of the coast. The higher parts of the ice plateau probably get some of their lowest temperatures with this type of circulation system.

(iii) *Mixed situations*, sometimes without well defined centres of high or low pressure at the surface, being either weakly cyclonic or anticyclonic in different parts of Antarctica, but becoming definitely cyclonic at higher levels. Such situations are believed to be rather common, especially with pressure relatively highest over the broadest part of Antarctica.

A fourth type is represented by the *travelling depressions* off the coast of Antarctica with their sectors of warm, maritime air aloft. This pattern gives:

(iv) Low pressure at the earth's surface in conjunction with a warm ridge of relatively high pressure in the upper atmosphere. The circulations are often intense, though commonly with a relatively calm region at the centre and in the frequently elongated central troughs of low pressure off the coast.

Cases in which these travelling depressions actually cross the coastline and penetrate Antarctica (apart from the peninsula of Graham Land) are still regarded as exceptional, though some cases have been recorded in analyses of the Australian and Pacific sectors. The upper warm ridge can presumably only penetrate Antarctica when it is driven in by strengthening northerly winds ahead of the surface depression. This implies that the surface depression is intensifying into a really big system and the tongue of warm air aloft must be of unusually large dimensions. This is fundamentally a situation which is changing from one with mobile pressure systems into a stationary pattern, liable to be accompanied by anticyclone formation over those parts of Antarctica ahead of the advancing upper warm ridge.

It is to be noticed that of the three commoner types of systems occurring over Antarctica, (i) and (ii) represent circulations developed in great depth through the atmosphere, whereas (iii) is weak and almost patternless at the surface but definitely cyclonic in the upper atmosphere. This means that, if we accept the above definitions of circulation types which have been recognized by various analysts, the three

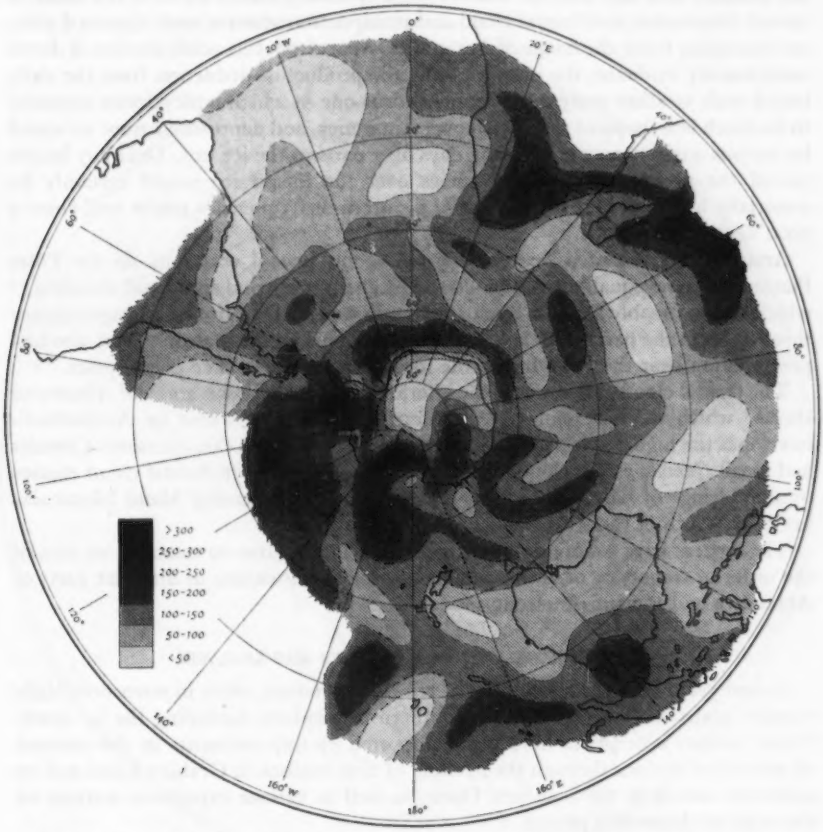

Fig. 2 Frontal frequencies, March 1947, indicated by Balaena expedition charts

(Frequencies are expressed as number of fronts occurring per thousand days within 10,000 *square nautical miles—approx.* 300 *mile radius— about any point)*

dimensional geometry of the individual pressure systems occurring from day to day in the Antarctic is generally simpler than has been supposed; for the more intense circulations are unchanged in character up to well above ice cap level.*

Probably no part of Antarctica is entirely immune from *fronts* (chiefly cold fronts and warm or cold occlusions) *and frontal snowfall*, though the unexplored central

* Some slant of the axis of most circulations must be allowed for, as in other parts of the world. The centres of anticyclones are displaced towards their warmer side aloft, whereas depressions lean to their colder side.

regions of East Antarctica may be relatively immune. A frontal frequency map for the month of March 1947 was tentatively derived from the daily weather maps of the *Balaena* expedition.[6] This map is here reproduced (Fig. 2) for the sake of the broad features of the pattern of frequencies in the far south. There were no observing stations on land in Antarctica outside the Graham Land peninsula, but the *Balaena* and her fleet of whalers were operating rather close to the coast in eastern longitudes, and frontal cloud and precipitation systems were observed over, and emerging from, the fringe of Antarctica. Apart from this small amount of direct confirmatory evidence, the map is purely the product of deduction from the daily broad-scale weather analysis. The month was one in which anticyclones appeared to be much less frequent than usual over Antarctica, and depressions were indicated by various analysts on a good many days over parts of the ice cap. Over any longer period the greatest frontal frequencies over the inland ice would certainly be materially less than here shown, but the pattern of frequencies might well show a good deal of similarity.

Amundsen [12] recorded heavy snow falling on several occasions on the Polar Plateau itself and squalls of wind followed by changes of wind speed and direction,[13] which were probably frontal. Such apparently well-marked frontal passages appear three times in the party's 46 days log of observations on the plateau. Scott also had precipitation near the Pole, but in the form of ice needles "like gorse spikes." [3]

The frontal cloud systems over the interior are mainly *Cirrostratus* and *Altostratus* sheets, which advance and retreat. More occasionally *Stratus* or *Nimbostratus* envelopes the higher levels of the ice cap in mist or fog. On rare occasions *Cumulus* and small *Cumulonimbus* clouds have been seen embedded in frontal cloud masses over the fringe of East Antarctica and as far south as Dronning Maud Mountains in 85° S., south of the Ross Barrier.[6, 13]

The writers have examined many sources of information to establish an idea of the order of frequency of anticyclonic and cyclonic situations in different parts of Antarctica and the sub-Antarctic zone.

Studies based on daily weather map analyses

Recent years have seen a number of efforts to produce, often in retrospect, daily weather maps covering most of the southern hemisphere, including the far south. These various enterprises have been supported by improvements in the network of observing stations through the opening of new stations in Graham Land and on scattered islands in the Southern Ocean as well as various expedition stations on the coast of Antarctica proper.

Already published results include:

(i) An interesting 8-day sequence from March 1947, re-analysed a year afterwards from the (British) *Balaena* [6] and (Dutch) *Willem Barendsz* expedition charts, illustrating the formation of an Antarctic anticyclone, after a cyclonic period.

(ii) Various daily sequences and (since January 1951) an unbroken series of monthly mean surface and upper air charts of the South African Weather Bureau, Southern Hemisphere Analysis Project.[14]

(iii) A current once-daily surface weather map analysis (also since 1951), covering the southern half of South America, Graham Land and the Weddell Sea, circulated in the Daily Weather Report of the Falkland Islands and Dependencies Meteorological Service, Stanley.

(iv) Twice daily chart sequences covering four months based on a particularly thorough collection of ships' logs organized in the southern summers and autumns of 1946–7 and 1947–8 by the Royal Naval Weather Bureau at Simonstown, South Africa and published by the Naval Weather Service [15], [16] in 1951. These two sequences are distinguished by a denser network of ships' observations, including the whaling fleets in the far south and the United States Expedition "Operation High jump," than any other so far produced.

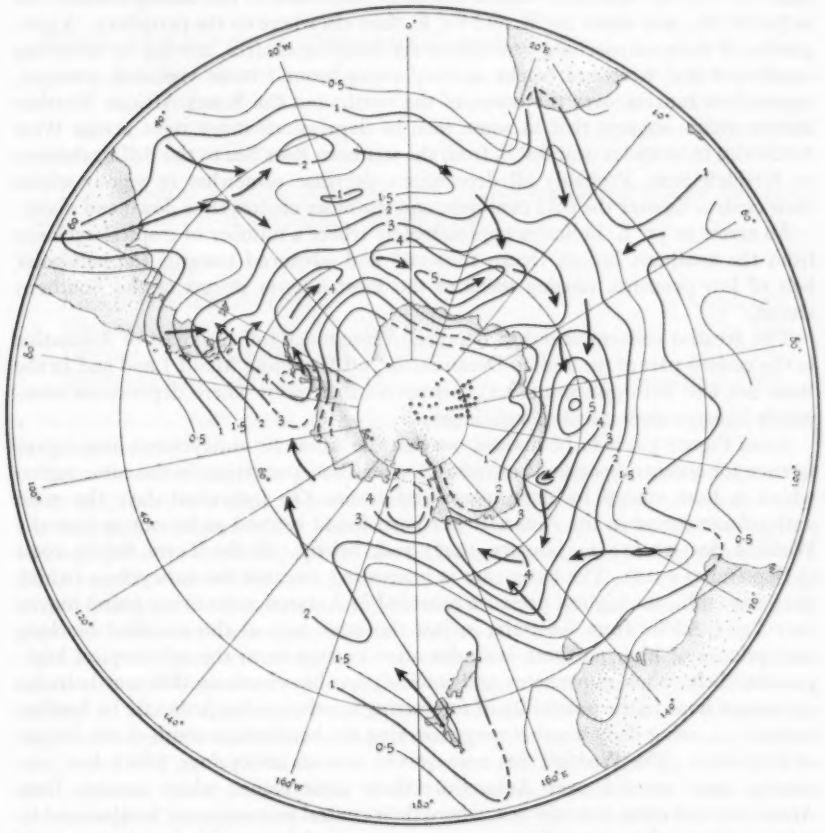

Fig. 3. Depression frequencies: Jan.–Feb. 1947; mid-March–mid-April 1947; mid-March–mid-April 1948

(*Mean monthly positions of the centres of anticyclones over Antarctica for each month Jan.* 1951–*Nov.* 1953 *shown by group of dots*)

Figure 3 presents the distribution of frequency of occurrence of depressions on these naval research charts for the total period January to mid-April 1947 and mid-March to mid-April 1948. Superimposed on this map are the monthly mean positions of the centres of the Antarctic anticyclones from the South African Weather Bureau charts for each month from January 1951 to November 1953 (latest available).

The isopleths show frequencies of depressions centred within an area of 100,000 square nautical miles (approximately 300 miles radius) about any point. The actual numbers on the isopleths refer to frequencies on the twice daily charts; when divided by two these figures give the approximate * frequencies of depressions in days per month. The main depression tracks stand out clearly on this map and are marked with arrows to show the usual direction of movement.

The map suggests a greater tendency for depressions to encroach over Antarctica near 120° E., east and south-east of the Ross Sea, south of the Bellingshausen Sea in 70–80° W., and about 20° E. and 80° E. than elsewhere on the periphery. A proportion of these encroaching depressions are decaying centres, moving on recurving southward and westward tracks as they swing around more vigorous, younger, depressions moving over the ocean to the north; but the South African Weather Bureau charts suggest that in some months depressions move right across West Antarctica in latitudes near 80° S. from the southern Ross Sea to the Bellingshausen or Weddell Seas. Probably all depressions decrease somewhat in vigour whilst their centres lie over the cold continent and the older centres slow down and decay.

An arrow in 55° E. indicates approximately where a number of tropical cyclones from the southern Indian Ocean recurved and advanced towards the sub-polar belt of low pressure, causing some of the most intense storms of the Southern Ocean.

The greatest concentrations of depression frequency (off the coast of Antarctica in the eastern part of the Indian Ocean sector, off Dronning Maud Land and in the Ross Sea and Bellingshausen Sea) correspond to regions where depressions commonly become slow-moving, and linger.

From Figure 3 it is to be noticed too that the Antarctic anticyclones have a preference for eccentric positions near 80° S. over East Antarctica, in the same region which is least visited by depressions and fronts. On individual days the main anticyclonic centre in the Antarctic has been found centred as far out as over the Weddell Sea ice (21–24 January 1947) and, briefly, off the Terre Adélie coast (3 September 1912). The latter case is interesting, because the anticyclone (which gave 1030 mb., the highest pressure recorded in Antarctica for many years) moved into Terre Adélie from Australia in just the same way as the so-called blocking anticyclones of high northern latitudes often emerge from the sub-tropical high-pressure belt. Such movements and interrelationships between different latitudes encourage hope in the possibility of forecasting weather in the Antarctic by familiar techniques, using daily weather maps covering the hemisphere south of the Tropic of Capricorn. The Weddell Sea case quoted was an anticyclone which had previously been centred over Antarctica; these anticyclones which emerge from Antarctica and come over the sea, where their central pressures can be observed by ships and coastal stations, give us our surest ground for considering that sea level pressures ranging from 995 to 1015 mb. are characteristic for the centres of Antarctic anticyclones.

Examination of the monthly mean pressures for months (twelve in all) during 1902, 1903, 1911 and 1912, when outstandingly high or low pressures occurred in the Antarctic (expedition stations being present in opposite sectors), reveals:

(i) 6 months in which pressures were above normal in all sectors of the Antarctic.

* The figures are not exact because the "monthly" periods chosen varied from 28 to 38 days.

Monthly mean pressures in extreme case (*December* 1911):

Ross Sea, MacMurdo Sound (78° S. 166° E.)	1007·5 mb.
,, ,, Bay of Whales (78° S. 164° W.)	1005·7 mb.
,, ,, Cape Adare (71° S. 170° E.)	1006·5 mb.
Weddell Sea, S/S Deutschland (*circa* 61° S. 30° W.)	1004·1 mb.
,, ,, Laurie Island (61° S. 45° W.)	1002·4 mb.

(ii) 2 months in which pressures were low in all sectors.

Monthly mean pressures in extreme cases (*October* 1911):

Ross Sea, MacMurdo Sound	976·0 mb.
,, ,, Bay of Whales	970·0 mb.
,, ,, Cape Adare	973·9 mb.
,, ,, Laurie Island	987·9 mb.

(iii) 4 months in which pressures were notably low on one side of Antarctica and normal or above normal on the other side.

e.g. *August* 1902:

Ross Sea, MacMurdo Sound	979·0 mb.
Gauss station (66° S. 90° E.)	976·4 mb.
Graham Land, Snow Hill (64° S. 57° W.)	984·1 mb.
Bellingshausen Sea (60° S. 80° W.)	994·4 mb.

In 1902 the highest pressures appear to have been over the Bellingshausen Sea for some months.

Cases in which the main anticyclonic central region of quiet weather is so far from the Pole as to occupy some Antarctic sea area for a month or more must cause a considerable increase in the production of sea ice in that sector. The occurrence of long spells of abnormal pressure distribution, affecting the mean pressures of a whole month, occasionally even of successive months, is likely to have correlations with subsequent ice conditions off the coast for much of that year and with the occurrence of precipitation and gales in and around Antarctica.

Perhaps the most cyclonic period of which we so far have evidence was the winter of 1940, when for three successive months Little America (Bay of Whales) in 78½° S. 164° W. had mean monthly sea level pressures of 972, 973 and 972 mb. (August, September and October respectively).[17] On 24 September 1940 a record low pressure of 932 mb. was observed.* On many occasions during these months the gales and precipitation belts of the depressions must surely have affected the Antarctic Continent from the Ross Sea at least to the South Pole.

On the other hand, periods of great pressure anomaly are often followed by a big change.[8] November 1911 gave mean pressures over the Ross Sea area 27 to 30 mb. higher than in October. October (as already quoted) had been obviously cyclonic in all sectors. November was anticyclonic in the Ross Sea and near the Pole, but remained relatively cyclonic (mean pressure 991·7 mb. at Laurie Island) in the Weddell Sea. By December the situation was generally anticyclonic, although near the beginning of the month Amundsen had a three-day blizzard on the Polar Plateau (presumably associated with a depression in the Pacific sector), when the wind reached Force 8.

* A pressure as low as 927·7 mb. has been observed *at sea* in the Bellingshausen Sea (67° S. 80° W.) on 29 October 1932.

Big changes of pressure, and therewith of prevailing windiness and weather type, from one month to the next, have been noted at all Antarctic stations, especially during the colder months from April to November. Sometimes three or four such changes occur in one year. Pepper [8] has noted that the most abrupt changes of monthly mean pressure are mostly rises of pressure. It must be remembered, however, that strong pressure gradients and gales may be found at the fringes of

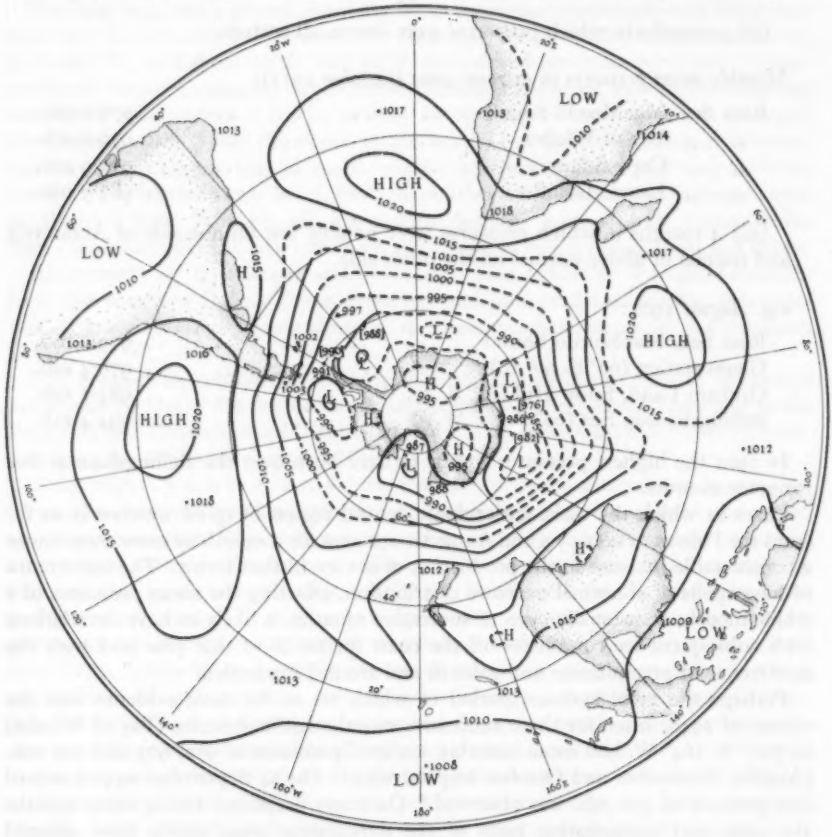

Fig. 4. Annual mean pressures at sea level

(*Figures in square brackets taken from 1946–7 whaling vessels' observations, using these figures indicative of probable yearly values over the same part of the Southern Ocean*)

high as well as low pressure systems. Probably the most extensive regions of light winds over the Antarctic continent occur when pressures are near normal and in weak and patternless circulations.*

* The intensity of individual depressions and anticyclones may to some extent be judged by how far their central pressures depart from the normal for the place at which they occur. Intensity is really a question of the pressure gradients present. Thus in the Antarctic and sub-Antarctic zones not all depressions of 970 to 975 mb. give rise to strong winds, whereas with the passage of a centre below 960 to 965 mb. gales may be expected to occur at some stage. Strong winds and gales in the Antarctic should also be looked out for on the flanks of any high pressure system in which the highest pressure is over 1005 mb.

Figure 4 reproduces the suggested distribution of annual mean pressure at sea level over the southern hemisphere, put forward by Lamb [10] in 1949 on the basis of the longest records of station values then available, amplified by reference to the *Balaena* expedition's southern hemisphere charts and the mean pressure values obtained by whaling ships in the 1946–7 summer (which nowhere showed anomalies of over 2 mb. in the far South from any known longer period normals). No more authoritative map of normal pressures covering the southern hemisphere is yet available; but it is remarkable how far the patterns of Figure 3 and Figure 4, drawn from separate periods and samples of evidence, repeat, and therefore tend to confirm, each other.

As regards seasonal variation of pressure over Antarctica the most that can be said with confidence so far is that, on the whole, pressures are highest and steadiest in summer, especially December and January, rather less so in November and February. In Graham Land and the Falkland Islands sector there are indications of a second period of high mean pressure in mid winter; in other sectors, including the southernmost parts of the Ross Sea, mean pressures are lowest in winter. In all parts of Antarctica, however, the months from March to October show great variations from day to day, from week to week and even from year to year: the highest and lowest pressures ever recorded at most places in Antarctica have occurred in these months; at some places in the *same* month in different years.

In very high latitudes the air circulation generally becomes noticeably slacker, with corresponding spells of fair weather and light to moderate winds, between about the beginning of December and the middle of February. However, this fair period is not entirely dependable: Shackleton [18] had a five-day blizzard with winds up to 80–90 m.p.h. in 88° S. on 7 January 1909, and the United States High jump Expedition in 1947 reported a considerable increase of storminess in the Ross Sea from mid-January onwards. Fine spells also occur in winter, but drastic changes are more frequent.

Statistical examination of observations from ships and shore stations

Figure 5a presents ratios of the frequency of winds with westerly to winds with easterly components experienced by ships at sea between 60° and 67½° S. in different sectors. The great majority of the ships' observations are undoubtedly those of whaling vessels within a few miles of the ice edge. Corresponding ratios for shore stations in the same zone of latitude are included for comparison. (A ratio of 1·0 means that cases of westerly and easterly components each constitute 50 per cent. of the observations other than those of calm or due N. and S. winds. A ratio of 3·0 means 75 per cent. westerly and 25 per cent. easterly components, whilst a ratio of 0·33 means 75 per cent. easterly and 25 per cent. westerly components. A logarithmic scale has been used for the ratio to give equal prominence to prevailing westerly or easterly winds.) Such ratios are to some extent a measure of the latitudinal position of the depression centres relative to the observation point.

The graphs will be found to correspond well with all the main features of depression frequencies (Fig. 3) in the zone south of 60° S., especially the great frequency of depressions well south of the sixtieth parallel in the Ross Sea, Bellingshausen Sea and near the Greenwich meridian. It will be seen, however, that the relative frequency of winds with westerly components is nowhere negligible at either ship or shore stations and generally amounts to 20 per cent. or more. Cape Denison

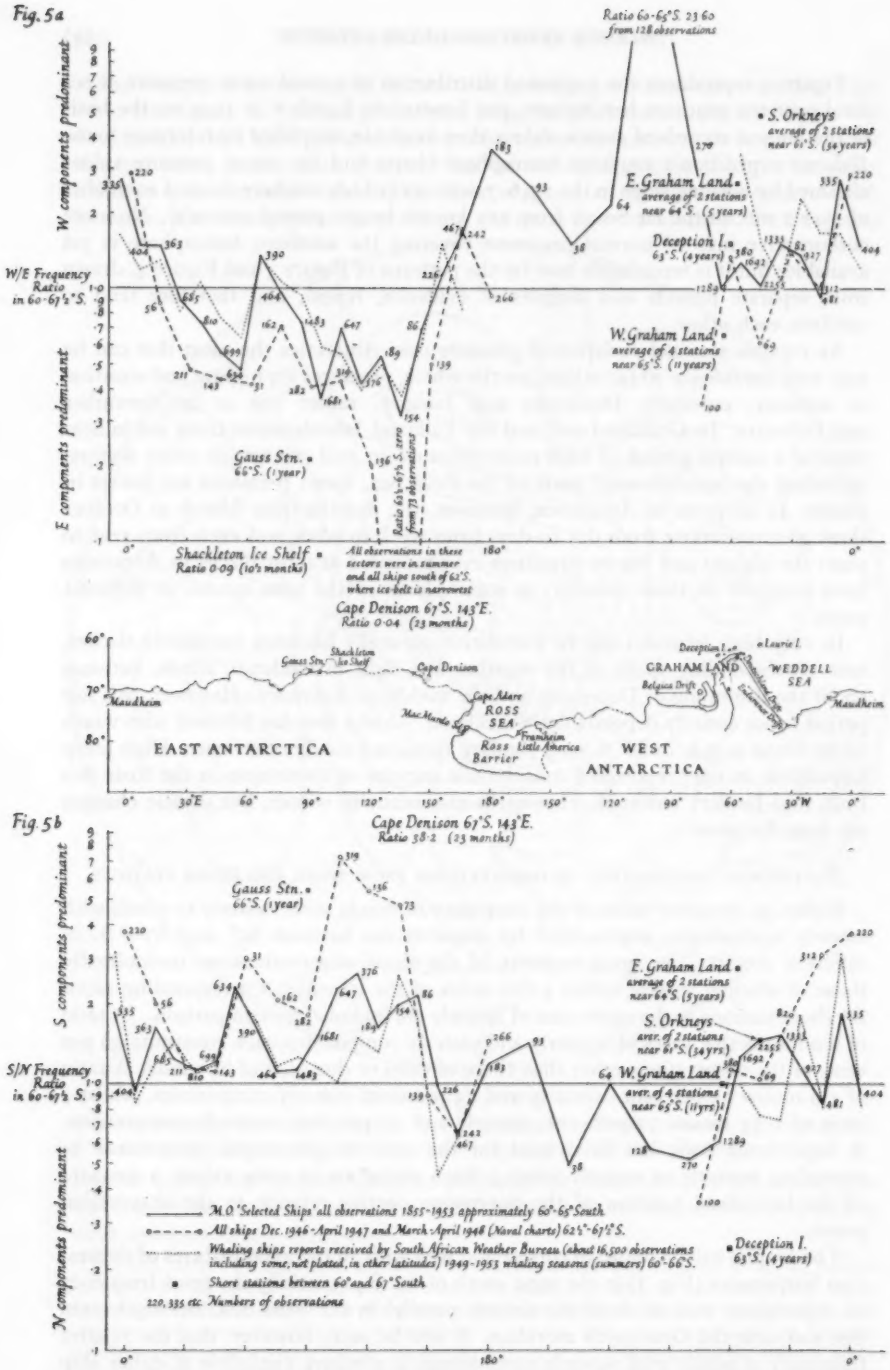
Fig. 5a
W components predominant
E components predominant
W/E Frequency Ratio in 60-67½°S.
Ratio 60-65°S. 23·60 from 128 observations
S. Orkneys average of 2 stations near 61°S. (34 years)
E. Graham Land average of 2 stations near 64°S. (5 years)
Deception I. 63°S. (4 years)
W. Graham Land average of 4 stations near 65°S. (11 years)
Gauss Stn. 66°S. (1 year)
Ratio 63½-67½°S. zero from 73 observations
Shackleton Ice Shelf Ratio 0·09 (10 months)
All observations in these sectors were in summer and all ships south of 62°S. where ice-belt is narrowest
Cape Denison 67°S. 143°E. Ratio 0·04 (23 months)
Gauss Stn.
Shackleton Ice Shelf
Cape Denison
Deception I.
Laurie I.
GRAHAM LAND
WEDDELL SEA
Belgica Drift
Maudheim
Cape Adare
ROSS SEA
MacMurdo Sound
Framheim
Little America
Ross Barrier
EAST ANTARCTICA
WEST ANTARCTICA
Fig. 5b
Cape Denison 67°S. 143°E. Ratio 38·2 (23 months)
S components predominant
N components predominant
S/N Frequency Ratio in 60-67½°S.
Gauss Stn. 66°S. (1 year)
E. Graham Land average of 2 stations near 64°S. (5 years)
S. Orkneys aver. of 2 stations near 61°S. (34 yrs)
W. Graham Land aver. of 4 stations near 65°S. (11 yrs)
M.O. 'Selected Ships' all observations 1855-1953 approximately 60°-65° South
All ships Dec. 1946-April 1947 and March-April 1948 (Naval charts) 62½°-67½°S.
Whaling ships reports received by South African Weather Bureau (about 16,500 observations including some not plotted, in other latitudes) 1949-1953 whaling seasons (summers) 60°-66°S.
Shore stations between 60° and 67° South
220, 335 etc. Numbers of observations
Deception I. 63°S. (4 years)

Fig. 5. Surface wind components in different longitudes 60°–67½° S. (logarithmic scale for ratio)

(a) *Ratio of frequencies westerly/easterly winds*
(b) *Ratio of frequencies southerly/northerly winds*

(67° S. 143° E.), where the winds blew virtually only from S. and SE., appears to be an exceptional locality; on the Shackleton Ice Shelf in 66° S. 95° E., just 7½ per cent. of all winds were westerly. The three separate curves in Figure 5a, representing independent collections of ships' observations and covering different periods of years, agree remarkably well together in all eastern longitudes, suggesting a good deal of consistency in the circulation patterns over East Antarctica in different years. The greater prominence of easterly winds affecting ships in 60–67½° S. in eastern longitudes is no doubt because here the comparatively regular coastline generally lies in 66–70° S., and is farther south elsewhere; but the much greater differences between the proportions of easterly winds shown by the different collections of ships' observations everywhere else suggests a certain consistency in the preference of Antarctic anticyclones for positions over East Antarctica and more variability elsewhere.

The relative frequency of westerly winds is greater, usually several times greater, in winter than in summer at Antarctic stations in all sectors—a fact already noticed by Meinardus.[4] Figure 6 shows how the ratio varies from month to month at Laurie Island (61° S. 45° W.) in the S. Orkneys (31 years mean) and at the Bay of Whales (78° S. 163–166° W.) in the Ross Sea (4 individual years): the latter gives some idea of the variations of one year from another in the frequency of westerly winds and cyclonic situations in high southern latitudes, especially in the colder months.

Figure 5b shows the frequency ratios of southerly winds (predominant with high ratios) and northerly winds (predominant with fractional ratios) in different sectors in 60–67½° S. Examination of the curves of these ratios supports the conclusions derived from Figures 3, 4 and 5a. The maxima of the ratios indicate where outbreaks of southerly winds from the Antarctic continent occurred most often. Southerly components predominate at the earth's surface in most sectors—practically everywhere between Graham Land and the whole sector of East Antarctica—whereas winds with northerly components appear to prevail at high levels (results of radio sonde and pilot balloon observations and observations of movement of upper clouds and of smoke from the Mount Erebus volcano). Wherever northerly components prevail, or are frequent, fog and much low cloud are prominent; regions of generally southerly winds have low frequencies of fog and relatively small average cloud amounts. Vowinckel and Oosthuizen [19] have produced maps of the frequency of fog and other elements over the Southern Ocean during the summer and autumn whaling seasons, which are readily interpreted in terms of these frequencies of various prevailing winds.

Digest of winds and weather observations on the Polar Plateau

Man has only sampled conditions on the Polar Plateau in two summers, 1908–9 and 1911–12, and available observations range from late November to early February in the Ross Sea sector. Extremes encountered cover everything from calm to hurricane force winds and fair to foul weather. We need some estimate of the frequencies.

Table 1 gives the frequency of different wind directions (referred to N. and S. along the 160° E. meridian) on the Polar Plateau in the Ross Sea sector compared with various coastal bases. The Maudheim figures are provisional and are those used by Swithinbank for his ice studies; [20] they were confined to days of rather steady wind direction and speeds over 5 metres per second.

TABLE 1.—PERCENTAGE FREQUENCY OF VARIOUS WIND DIRECTIONS

Place	*Position*	*Period of observations*	*N.*	*NE.*	*E.*	*SE.*	*S.*	*SW.*	*W.*	*NW.*	*Calm*
Polar Plateau in the region of the Pole south of the crest ..	88–90° S. 150° E.–160° W.	(Scott's party's obs.) 21 days	0	0	5	16	**46**	19	6	3	5
Polar Plateau ..	85–90° S. 150° E.–160° W.	124 days (Shackleton, Amundsen and Scott's obs.)	1	3	4	15	**57**	6	2	2	12
MacMurdo Sound	78° S. 166° E.	4 years	9	11	22	**26**	5	1	1	3	19
Bay of Whales ..	78° S. 164° W.	4 years	4	5	**32**	10	19	16	4	1	8
Cape Adare ..	71° S. 170° E.	$13\frac{1}{4}$ years	3	2	9	**19**	16	4	3	5	**39**
Gauss station ..	66° S. 90° E.	1 year	0	2	**57**	11	5	3	9	2	11
Maudheim * ..	71° S. 11° W.	$13\frac{1}{4}$ years	(0)	(14)	(**52**)	(4)	(18)	(9)	(2)	(0)	—

* Provisional data: winds over 5 m./sec. at Maudheim.

The like predominance of easterly winds along the coast of East Antarctica, of south-easterly winds in Terre Adélie and at Cape Adare (where frequent calms are due to shelter from the SE. and E.) and of S. winds on the Polar Plateau corresponds to the frequency, probably 60 to 70 per cent., of anticyclonic centres, weak or intense alike included, over the broadest part of East Antarctica between Enderby Land and the Pole. It is important to notice that south of 88° S. the prevailing S. winds were blowing *up* the slope of the plateau. The difference of level between 88° S. and the Pole is estimated as about 300 metres (1000 feet) on the 160° E. meridian.

The frequency ratios, for comparison with Figures 4 and 6, work out as westerly/easterly 0·49 and southerly/northerly 8·27, for the Polar Plateau. There is thus no sign at this level of the net inflow of winds suggested by the observed directions of motion of the higher clouds. On the contrary, the observations are consistent with the suggestion that the Plateau experiences the wind circulation of the sea level pressure systems.

TABLE 2: PERCENTAGE FREQUENCY OF WINDS OF DIFFERENT FORCE DURING SCOTT'S JOURNEY.

Beaufort Force	0	1	2	3	4	5	6	7	8	9	10	11	12
85–90° S. 126 obs.	9	13	10	22	23	11	4	4	2	0	0	0	0
88–90° S. (South of the crest) 63 obs.	6	11	14	19	19	13	6	6	5	0	0	0	0

Amundsen had 18 per cent. winds Force 5 or over (*i.e.* blizzard strength), in his 46 days on the plateau, strongest wind Force 8. Scott had 21 per cent. winds Force 5 or over, strongest Force 8, in 44 days on the plateau. Shackleton in his 34 days on the plateau had 33 per cent. winds Force 5 or over. His strongest wind was Force 12.

A month's unbroken spell of southerly winds at the height of summer, culminating in a 5 day blizzard in early January 1909, together with shortage of food, turned Shackleton back from his attempt to reach the Pole. The other parties each experienced a 3 day blizzard, but had more changeable, predominantly fair, weather with lighter winds and sunshine. The lowest temperatures and clearest weather went with periods of light, variable or westerly winds both on the plateau and at the Gauss station on the coast on the opposite side of East Antarctica.

The periods of southerly gales on the plateau must presumably be attributed to the influence of depressions in the Pacific sector at times when there is a strong gradient of pressure from an anticyclonic centre over East Antarctica. It is probably reasonable to assume that the maximum width of such fast moving airstreams is of the same order here as over the oceans and off the coast of Antarctica. This

suggests that the fronts and low pressure centres or troughs with which the strong winds are associated must commonly lie near the line of the Dronning Maud Mountains or move along tracks near 80° S. over West Antarctica. A low pressure trough with its axis in 82° S. between the Ross and Weddell Seas was a prominent

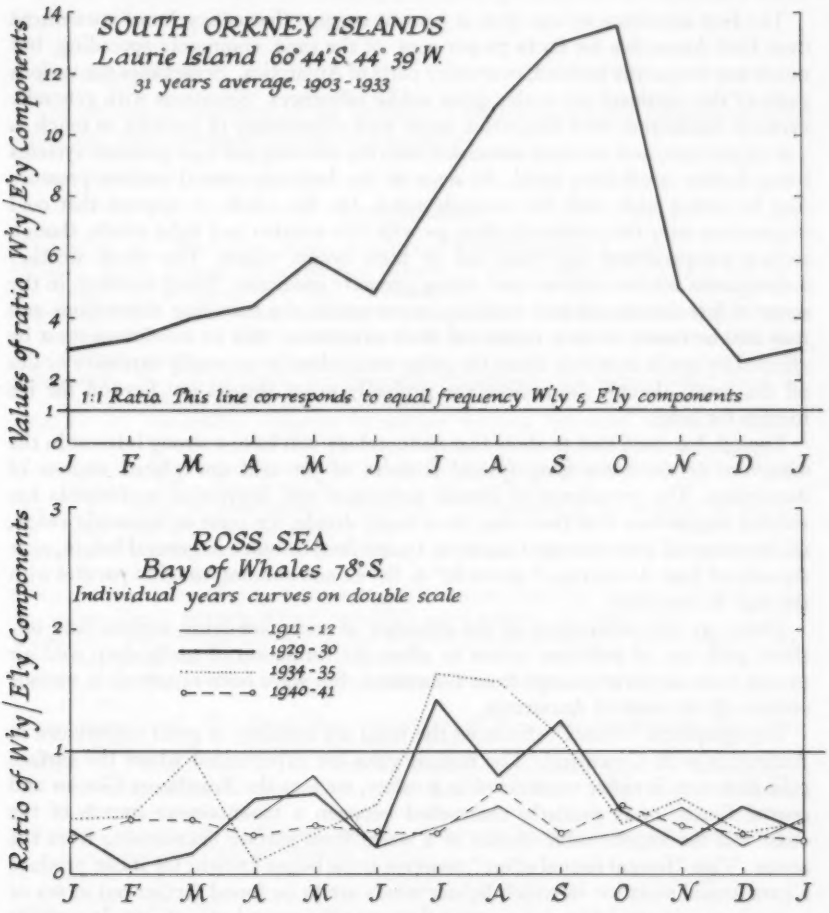

Fig. 6. Ratio of frequencies westerly/easterly surface wind components in different months

feature of the South African Weather Bureau charts in May, July, August and September 1953.

The likely whereabouts of the other limit of the southerly gales of the Polar Plateau raises interesting, and at present unanswerable, questions. It seems likely that there is a marked decrease of gale frequency on the other ("eastern") side of the Pole, towards the unexplored region of East Antarctica; but the frequency of strong winds, mainly from one direction, in the region of the Pole suggests they

may conform to some major topographical feature, such as the flank of a range of high mountains.

Conclusions

The best estimates we can give at present suggest that anticyclones are centred over East Antarctica for 60 to 70 per cent. of the time, commonly spreading, but much less frequently centred, over other parts of Antarctica. Sometimes the various parts of the continent are under quite unlike influences. Situations with generally cyclonic circulation over Antarctica occur with a frequency of perhaps as much as 5 to 15 per cent. and are often associated with the sub-tropical high pressure systems being further south than usual. At some of the Antarctic coastal stations pressure may be rather high with the westerly wind. On the whole, it appears that cold depressions over the continent often go with fair weather and light winds, though surface temperatures may then fall to their lowest values. The worst weather accompanies intense systems and strong pressure gradients. Thick weather, in the sense of low clouds and bad visibility, accompanies the travelling depressions and may also be found in some regions of slack circulation. Sea ice conditions must be affected by spells in which either the polar anticyclone is unusually extensive or lies off the coast, though the anticyclone probably never thrusts out beyond the ice margin for long.

Enough has been said to show that meteorology will have a strong interest in the discovery of the main geographical features of the still unexplored regions of Antarctica. The prevalence of certain airstreams and depression movements has yielded suggestions that there may be a major divide, ice crest or mountain range, of the order of 4000 metres (12,000 to 15,000 feet) or more in general height, near the axis of East Antarctica,[21] about 80° S. 80° E. and running roughly parallel with the 140° E. meridian.

There are also indications of the existence of some low-lying regions (and off-shore pack ice) of sufficient extent to allow the formation of really deep cold air masses such as never emerge from Greenland, but have been observed in various sectors off the coast of Antarctica.

Topographical "funnel" effects on the wind are certainly of great importance in Antarctica as in Greenland. The fiercest gales are experienced where the surface cold airstream is either constricted in a valley, such as the Beardmore Glacier and coastal fjords, or is similarly channelled between a mountainous stretch of the coast and the impenetrable barrier of a warm front surface encroaching from the ocean. This "frontal funnel effect" deserves to be better known; for it can produce a paradoxical situation in which lighter winds are to be found farther out at sea or in a more open exposure on ice rather than near the coastal mountains. It explains why the open surface of the Ross Barrier at Framheim and the Bay of Whales was actually less exposed to strong winds than MacMurdo Sound, which lies much closer to the mountains.

The phenomenal preponderance of southerly winds of great strength at Mawson's Terre Adélie base, Cape Denison (67° S. 143° E.) in Commonwealth Bay, is probably a topographical effect, though the topographical features which could explain it have never yet been found. This may be an example of persistence over the ice, for unknown, and perhaps great, distances downstream, of concentration of the windflow in some unknown channel far in the interior. Cases which are to some degree analogous may be discerned even over the Mediterranean Sea, where the

Rhône Valley and Carcassonne Gap, the Sicilian Narrows and the Straits of Gibraltar affect gale frequencies for hundreds of miles out over the sea. Alternatively the formidable concentration of the surface wind, which gave a mean annual windspeed of 38 knots at Cape Denison, may possibly be due solely to folds of the ice cap surface itself (ice valleys) and convergence of the katabatic flow (cold air drainage).

ACKNOWLEDGMENT

The authors are indebted to the Director of the Meteorological Office and to the Admiralty for permission to publish this article.

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THE TERRACES OF THE SALISBURY AVON

K. R. SEALY

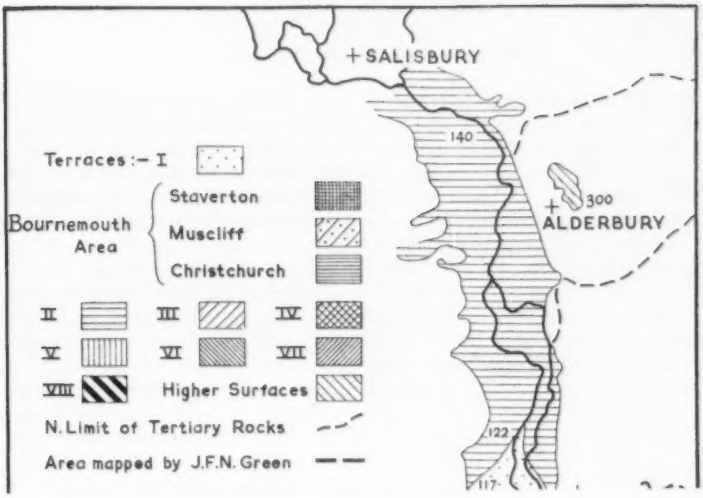
THE FOUNDATION of our knowledge of the Salisbury Avon and its terraces was laid by Clement Reid (1902),[1] whose work was later modified by the studies of Osborne White (1917), Bury (1920, 1923, 1933), and J. F. N. Green (1936, 1946). The paper by Green on the terraces of the Bournemouth area (1946) was the first to employ intensive geomorphological methods to problems of river erosion in this area. The pioneer work that he accomplished has been extended northwards along the Avon valley as far as Salisbury, and the purpose of this paper is to present the results that have been obtained in this middle section of the valley, so that a more complete picture of the terrace succession may be made.

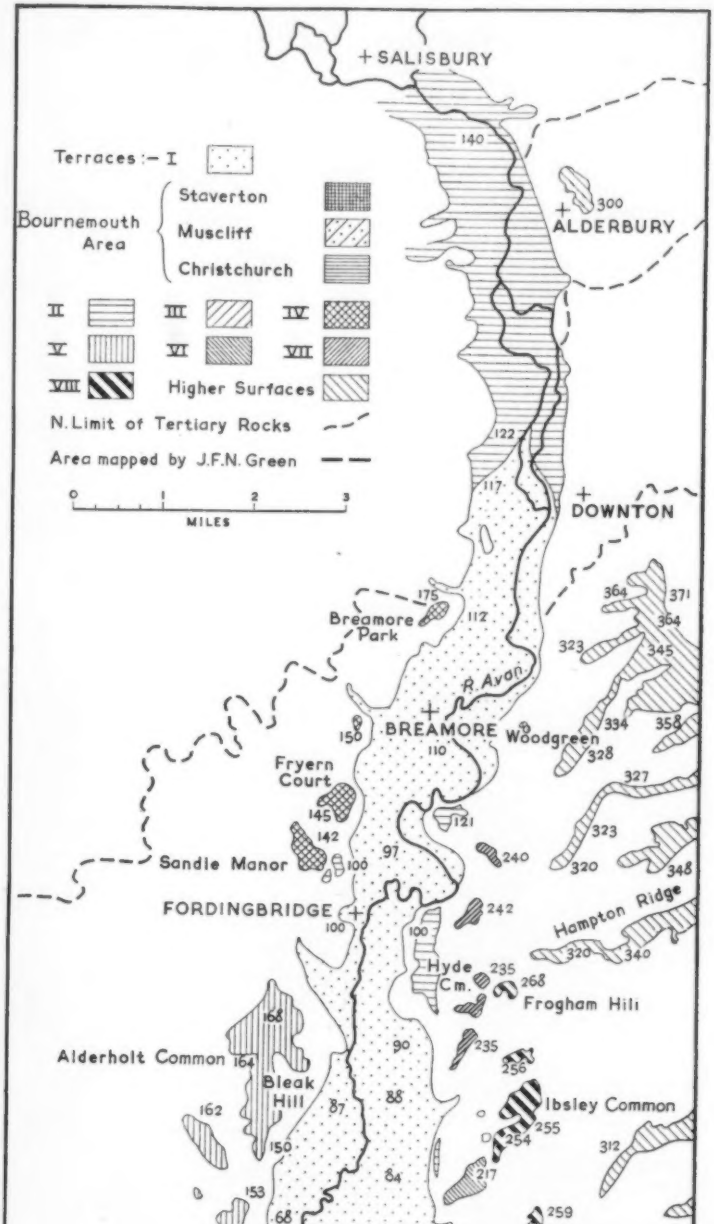
The River Avon results from the union of a complex of small streams which have their sources either in the Vale of Pewsey, or in the chalk country to the north. At Rushall, the two main branches unite to form the single river, and from this point it flows almost due south, across the structural grain of the country, to tidehead near Christchurch. From Rushall to Downton the Avon is a small stream deeply incised in the chalk, while in the lower section of its course over the Tertiary strata between Downton and Christchurch, it flows in a broad valley bounded by steep rises to the New Forest in the east, and the hardly less striking country to the west.

The bulk of the evidence to be considered is to be found south of Downton where the river has not been so strictly confined in its course. Thus each succeeding phase of downcutting has not completely removed the traces of the older flood-plains that may now be discerned as terraces on the valley sides. Nevertheless, it is rare to find any single terrace preserved on both sides of the valley in the same area, and the record consists of a series of disconnected fragments; a situation that poses difficulties in correlation. On the east bank, recent erosion by small streams draining from the high ridges of the New Forest, has cut up the valley side into a number of well-marked plateaus, *e.g.* Hyde and Ibsley Commons south-east of Fordingbridge. It is upon the crests and flanks of these ridges that the record has been preserved. On the west bank the position is similar, though not so impressive scenically. The older terraces are here indifferently preserved, having been destroyed by later phases of downcutting, so that only the later links in the record can be found. Perhaps the most striking feature lies between Ringwood and Fordingbridge, where for some five miles Terrace V has been almost continuously preserved. West of this area the small Ebblake stream has cut into the back of the terrace, while to the east, a continuous slope to the flood-plain reinforces the isolated appearance of the terrace. This pattern is repeated with variations throughout the valley and serves to emphasize dramatically the earlier phase in the river's development.

Field mapping was carried out on the 6-inch scale, and the results were then transferred to the 1/25,000 scale maps. The delineation of the surfaces was aided by careful attention to height measurements with the aim of attaining an accuracy of approximately 3–5 feet. The measurements were made with reference to Ordnance Survey spot heights and surveyed contours, and supplemented where necessary by short traverses with an Abney Level from known datum points. Since measurements were taken to the surface of each relic, the nature and extent of the overlying drift cover had to be considered. Lithologically, the drift is remarkably uniform as Clement Reid (1902) first observed. The drift consists of angular and sub-angular flint derived from the chalk, Tertiary flint pebbles, and smaller quantities of quartz and sandstone. Clement Reid recorded the presence of rarer specimens of Jurassic material at all

[1] References are listed alphabetically by authors' names at the end of the paper.


+SALISBURY
140
300
+ ALDERBURY
122
117
Terraces :– I
Bournemouth Area
Staverton
Muscliff
Christchurch
II
III
IV
V
VI
VII
VIII
Higher Surfaces
N. Limit of Tertiary Rocks
Area mapped by J.F.N. Green


+SALISBURY
Terraces :- I
Bournemouth Area
Staverton
Muscliff
Christchurch
II
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Higher Surfaces
N. Limit of Tertiary Rocks
Area mapped by J.F.N. Green
0 1 2 3
MILES
140
300
+ALDERBURY
122
117
+DOWNTON
175
Breamore Park
112
364
371
364
323
345
R. Avon
+BREAMORE
Woodgreen
334
358
328
150
110
Fryern Court
327
145
142
121
323
Sandle Manor
100
97
240
320
348
FORDINGBRIDGE
100
242
100
Hampton Ridge
320
340
Hyde
Cm.
235
268
Frogham Hill
168
90
235
256
Alderholt Common
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Bleak Hill
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87
88
Ibsley Common
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254
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312
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153
84
68
259

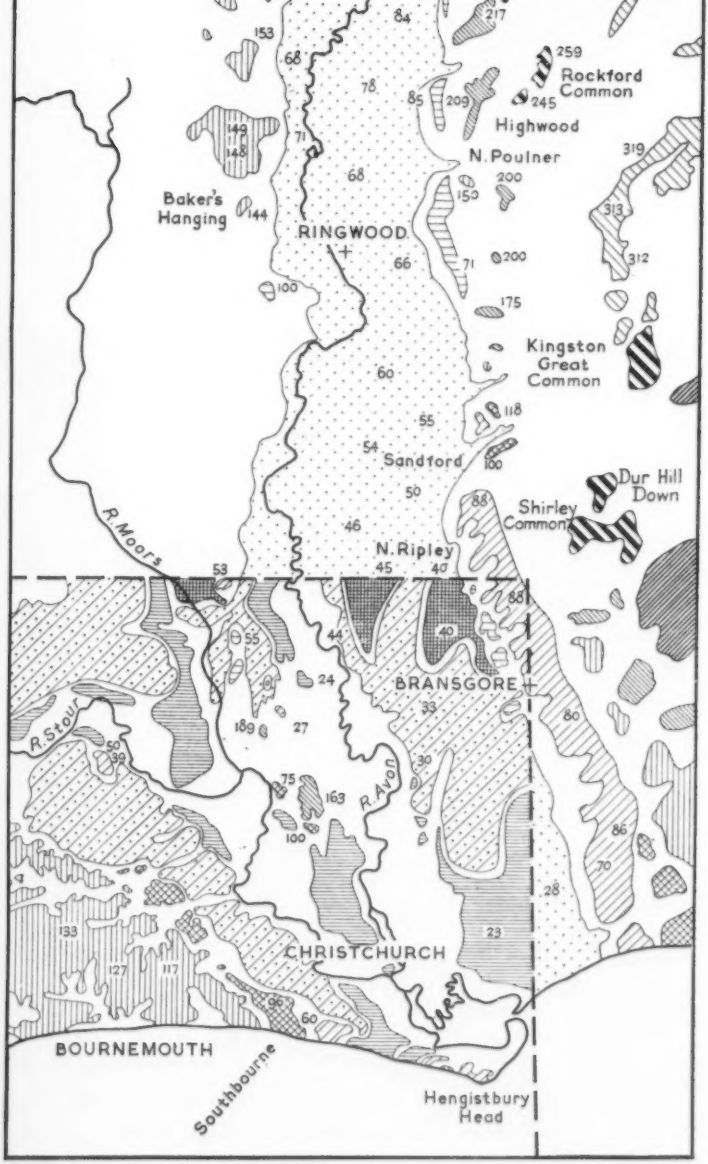
Rockford Common
Highwood
N. Poulner
Baker's Hanging
RINGWOOD
Kingston Great Common
Sandford
Dur Hill Down
Shirley Common
N. Ripley
R. Moors
BRANSGORE
R. Stour
R. Avon
CHRISTCHURCH
BOURNEMOUTH
Southbourne
Hengistbury Head

Figure 1

levels, derived from the high level drifts of the New Forest. All the material could have been derived from the present limits of the river's drainage basin, although the presence of the Jurassic fragments poses interesting problems concerning the origins of the New Forest gravels, a matter that does not concern us here. In the terraces above the level of the Vth, the gravels are from 5 to 10 feet in depth, deprived of much of the finer material, and relatively structureless in form. The lower surfaces exhibit a cover of 15–20 feet of well sorted river gravels, regularly interbedded and containing a much higher proportion of finer material. The archaeological significance of these gravels is at present limited, not from a lack of specimens, but rather from the fact that in many cases the precise location of the finds has not been recorded. The careful work of Green and Calkin (1949) in this field is an outstanding exception, and has done much to clarify the picture in the Bournemouth area. From the geomorphological standpoint, differences in the depth of the drift must be taken into account, since some terraces have suffered from recent erosion more drastically than others. In practice this means that any given terrace will exhibit a range of heights, a matter that gives rise to little confusion since the terrace intervals are large enough to permit the recognition of each stage.

Finally, it should be noted that in the following discussion the terms "inner edge" and "back" are used to denote the edge of the terrace nearest the stream, and the junction zone between the terrace and the succeeding bluff respectively (Fig. 2). Since the present results have been linked with evidence in the valley of the River Test, the terraces have been numbered in sequence to obviate the confusion in local names applied to the terraces in the past. The names given to the various stages by Green are added in brackets, so that reference to his work is facilitated.

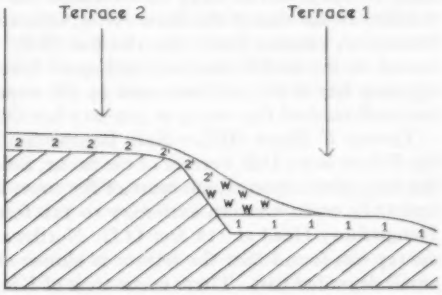

Fig. 2. A diagrammatic transverse section to show relationship of terrace deposits

THE TERRACES (Fig. 1)

Green recognized eight river terraces, one non-fluvial terrace, and a number of graded reaches, in the valleys of the Dorset Stour, the Solent and the Avon, near Bournemouth. In the case of the non-fluvial terrace, the 300-foot Sicilian Terrace, it is felt that its widespread occurrence merits separate consideration, and the problems it poses are left for future discussion. All eight of the fluvial terraces have been traced upstream, though no attempt has been made to divide the main flood-plain as Green did near Bournemouth. In the area north of Bournemouth, morphological differences are small in the flood-plain, and the matter is seriously complicated by the artificial channels that mark the old water-meadow system. Thus the series of graded reaches cited by Green below the level of the 2nd Lower Taplow Terrace, are here included as one surface—the flood-plain.

Terrace VIII (*Upper Ambersham*).—This terrace, the highest of the river terraces, has been preserved in the Avon valley on the east bank of the river. Some five miles north-east of Christchurch, Green mapped part of the terrace on Dur Hill Down and Shirley Common, at a height of 240–250 feet O.D. Upstream, the present survey found that the terrace is absent for a distance of 4 miles, but appears again as a series of flats stretching from Rockford Common, north-east of Highwood, to Frogham Hill, south-east of Fordingbridge. In height these remnants range from 255–259 feet O.D., in the south, to 263–268 feet O.D. on Frogham Hill.

Terrace VII (*Ambersham*).—Within the Bournemouth area, Green mapped the Ambersham Terrace just east of Bransgore village at 190–210 feet O.D., although in this instance it appears to be a terrace of the old Solent river. Nevertheless, the presence of the VIIIth terrace immediately north-west of this point at Shirley Common, indicates that we cannot be far from the Avon–Solent junction at this time. Upstream the terrace occurs on the east bank again, immediately east of Fordingbridge, where five flats are found ranging from 235–242 feet O.D. These flats form the "150-foot Terrace" of Westlake (1889), and were thought by Green to correlate with his Sleight Terrace. In fact they more nearly conform to the VIIth (Ambersham) Terrace in height. The relation of this terrace with the VIIIth is best observed on Hyde Common, where the VIIth terrace is well preserved, and separated from the VIIIth on Frogham Hill by a marked bluff.

Terrace VI (*Sleight*).—This terrace was first recognized on the Dorset Stour by Bury in 1923, and in 1933 he correlated the flats on St. Catherine's Hill with this terrace. In the case of the lower Avon, Green mapped the terrace as occurring east of Bransgore, ranging from 165–180 feet O.D. The terrace is very indifferently preserved in the middle reaches, and apart from four small flats east of Ringwood at 175–205 feet O.D., it is best seen on the western side of Rockford Common, where two well-marked flats occur at 210–217 feet O.D.

Terrace V (*Boyn Hill*).—Near Bournemouth, within the area mapped by Green, the Vth or Boyn Hill Terrace of the Stour, Solent and Avon, is well marked. It forms the long plain upon which most of the town is built, and ranges in height from 150 feet O.D. at its western extremity to 120 feet O.D. in the east. It occurs again on Hengistbury Head at 116 feet O.D. Northwards along the Avon valley, the present survey has found that the terrace is almost absent on the east bank except for two small degraded flats. These occur west of Kingston Great Common at 135 feet O.D. and at North Poulner at 150 feet O.D., some two miles further north. The greatest extension of the terrace is to be found on the west bank, where it forms an almost continuous feature from Ringwood to Fordingbridge, a distance of nearly five miles In places the terrace is as much as a mile in width. The height range of this section rises from 144–148 feet O.D. in the south, to 168–175 feet O.D. in the area west of Fordingbridge. Upstream from Fordingbridge, the terrace has been cut out by a later surface, but a search for its occurrence on the east bank reveals its presence in imperfect form on Wood Green Common, east of Breamore, at 200–210 feet O.D.

Terrace IV (*Upper Taplow*).—Immediately north of Fordingbridge at Sandle Manor and Fryern Court, on the west bank of the river, a well marked terrace is preserved at 142–145 feet O.D. This is the "50-foot Terrace" of Westlake (1889), and it can be traced as a series of flats as far north as Breamore Park, where it reaches a height of 170–175 feet O.D. Near Fordingbridge the terrace is some 20–25 feet lower than the Vth Terrace which occurs south-west of the town. Elsewhere, no well preserved relic of this terrace can be found until the Bournemouth area is reached, where at Southbourne on the west bank, and at Highcliff on the east, the Upper Taplow Terrace was mapped by Green at a height of 90–100 feet O.D. Between Fordingbridge and Southbourne one small flat remains to be recorded. This occurs near Sandford at 118 feet O.D. on the east bank, and is separated by a shallow decline from a smaller flattening on the spur at 105 feet O.D.

Terrace III (*1st Lower Taplow*).—The Bransgore Terrace of O. White (1917) appears on Green's map as an almost continuous feature from the coast to North Ripley, and formed part of his 1st Lower Taplow Terrace. The terrace is in fact continuous as far north as a point just south of Sandford, as Green suggested, and over its whole length ranges in height from 65–75 feet O.D. near the coast, to 85–90 feet O.D. at its northernmost extension. Beyond this point the terrace appears again as a small flat north and east of Sandford at 105 feet O.D.—the feature already alluded to under the description of the IVth Terrace. A study of the longitudinal gradient

characteristics of both of IVth and the IIIrd terraces suggests that the latter runs into the IVth at a point not far north of Sandford.

Terrace II (*2nd Lower Taplow*).—Before the flood-plain is reached, there is evidence of one further low terrace which may be traced from the Bournemouth area northwards beyond Fordingbridge, and was recognized by O. White (1917), and later by Bury (1920). In the lower Avon, Green mapped this terrace as a series of flats west of Bransgore at a height of 50–55 feet O.D. Further evidence can be observed near Ringwood at 71–85 feet O.D., and again near Fordingbridge, where the terrace reaches the 100-foot contour just east of the town. Near Breamore the terrace becomes the present flood-plain.

Terrace I (*Flood-plain*).—The flood-plain has been mapped as a single terrace although its surface is by no means homogeneous, being marked by small discontinuous features often only a few feet above the general level. Much of the surface is cut up by minor channels, some of which are artificial, and connected with the water meadows that are such a feature of the lower levels of the valley. Nevertheless it is more than possible that the terraces shown by Green as existing below the 2nd Lower Taplow (Terrace II) in the Bournemouth area are present in the downstream section of the area surveyed here, although inspection of the ground suggests that morphological evidence alone is very inconclusive.

Bases of correlation

The foregoing description of the terraces of the Salisbury Avon has been a statement of results, and it is the purpose of this section of the paper to discuss how these results have been achieved.

Fundamentally, the task has been rendered more difficult by the persistency with which the Avon has followed a course almost unchanged since Upper Ambersham times. As will have been observed, very little evidence is forthcoming from that section of its course north of the boundary of the Tertiary strata, where the river has been more strictly confined in the Chalk. Even south of the boundary, the evidence is discontinuous, and the correlation of the features observed made difficult.

Locally, the flats in the Avon valley fall into closely related series which can be observed as such in the field. Perhaps the best example of this is afforded by the group of five flats forming the Vth (Boyn Hill) Terrace between Ringwood and Fordingbridge (see Fig. 1). The problem is to establish the relationship between each of several discontinuous series, a problem which can be at least partly solved by a study of the longitudinal gradients. A profile segment may be drawn of each series from careful height measurements made on the individual flats, but the question immediately arises as to the position of the chosen line of the profile along the terrace. At first sight it would appear that measurements along the inner edge should be taken, as representing the point nearest the course of the river, but subsequent erosion and down-wash have obscured the original arrangement of the drift at this point (Fig. 2). For similar reasons the back of the flats do not prove suitable, and a median line was eventually chosen. In addition, the depth of the drift cover along the chosen line has been checked as far as possible from the information to be derived from the geological map and memoirs, and from gravel pit sections observed in the field.

The five flats of the Vth Terrace between Ringwood and Fordingbridge serve as a good example to illustrate the method, and the following discussion deals with this series. The height measurements made along the median line of the flats were plotted on squared paper, and appeared as a set of closely spaced points representing a short segment of the terrace profile. It now becomes necessary to determine the characteristics of this segment.

The nature of the longitudinal profile of a river has long occupied the minds of engineers and geomorphologists. For our purpose it is sufficient to note the work of Green (1936), who extended the earlier work of Sternberg (1875), and of O. T. Jones (1924) on this subject. Green approximated simple logarithmic curves to carefully

measured "graded reaches" situated above the major knickpoints on the present river profile, and applied his findings most successfully to the River Test (1946). This method has been severely criticized, particularly by Miller (1939), and indeed it must be admitted that so many variables are present, and the measured reach is so short compared to the profile as a whole, that even a small error produces a large difference in the extrapolated curve downstream. Apart from recent criticism of the concept of grade (Kesseli, 1941), which underlies the analysis of Green, it must be remembered that his curves are fitted to a "graded reach" which, while representing a section of an older river profile, is still occupied by the river, and must have suffered change over the intervening period of time. The alternative is to fit a curve to a well-preserved segment of a terrace, which would seem to allow a more accurate result. Nevertheless, it is rare to find a well-preserved terrace over any distance, and this is particularly so in the Avon valley, so that the method becomes too refined for the data available.

At the other extreme, where a large river is being considered, and one whose terraces are particularly well preserved, it is possible to consider the longitudinal profile as a straight line for purposes of correlation. The terraces mapped by Hare in the Thames Valley (1947) fall into this category. It is probably wisest to realize that the degree of refinement of technique must depend on the individual case, and in the present survey a method intermediate between the linear case and the methods of Green has been employed.

A study of the succession of points measured on the Ringwood–Fordingbridge flats showed that they occurred as a band decreasing in height downstream—a

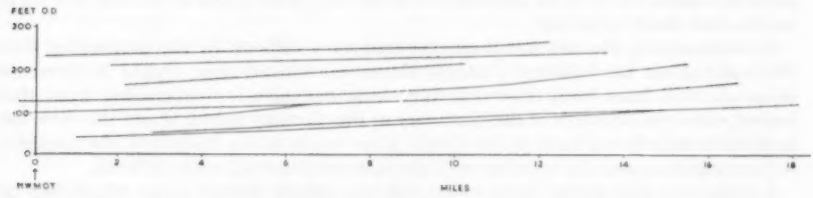

Fig. 3. Longitudinal profiles of the Avon terraces

succession which could not be successfully considered as a straight line. If, however, the whole section is sub-divided into smaller parts, then each part becomes almost a straight line. If each part is taken as such, its gradient may be rapidly ascertained, and by comparison with its neighbours, the rate of change of gradient can also be found for the whole section. Since the radius of curvature of the whole segment is small, little error is introduced by considering the rate of change as constant in this case. The whole section of the profile was taken as representing a curve whose rate of change of gradient is equal to $\frac{5}{8}$ths of a foot per mile. If the curve so obtained is projected downstream from the southernmost point of the section at Baker's Hanging (Fig. 1), with an initial gradient of 5 feet per mile, then the gradient will be reduced to zero 8 miles downstream. At this point we should expect the terrace to be found at 125 feet O.D., and since the gradient is zero, we should also expect this point to be near the mouth of the river for the terrace. The result accords well with the findings of Green, whose Boyn Hill Terrace is found at this point at 125–130 feet O.D., as shown on his map (1946). Further, the Boyn Hill Terrace of the Avon near Bournemouth runs into that of the old Solent river, whose terrace Green tentatively mapped eastwards to Southampton Water. He noted that the longitudinal gradient of this stretch was almost negligible, forming what he termed a "horizontal segment." We may in similar fashion extend our curve upstream, in which case the small flat at Wood Green at 200–210 feet O.D. falls very close to the expected height for this terrace, the curve reading 194 feet O.D. at Wood Green. It must be remembered that the rate of change of gradient is likely to increase upstream, and allowance must be made for

this when comparing the two heights. Apart from the two small flats at Kingston Great Common and North Poulner, no other flats approach within 20 feet of the curve.

By this method the relationships of the majority of the flats preserved in the Avon valley were correlated, and the results linked with the terrace flight established by Green in his Bournemouth study. The completed longitudinal profiles are illustrated in Figure 3, and a diagrammatic representation of the terraces in Figure 4. It was not expected that every flat mapped in the field survey could be conveniently "pigeon-holed" for, as Baulig has stressed, the river must have occupied all positions from the

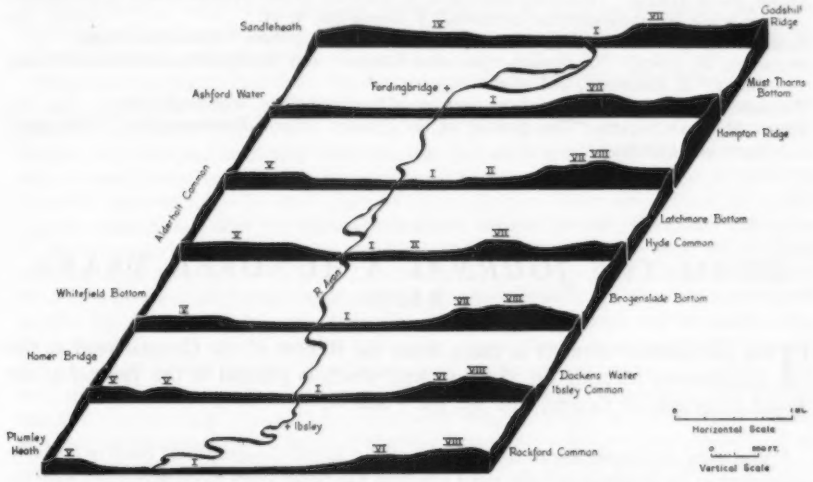

Fig. 4. Transverse valley profiles (Ibsley–Fordingbridge)

top of the valley to the bottom, and the fact that separation into a series of major terraces is possible, shows that changes in base level have been spasmodic rather than continuous—a concept that needs no elaboration here.

The final sequence may be summarized as follows:

Terrace height in feet above Ordnance Datum

Terrace	*Ringwood*	*Bournemouth*
VIII	250	232
VII	225	205
VI	197	155
V	140	122
IV	124	100
III	(120)	72
II	78	42
I	68	35
Present river level ..	50	—

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FROM THE *JOURNAL* A HUNDRED YEARS AGO

THE FOLLOWING EXTRACT is taken from the Report of the Council read at the Anniversary Meeting on 28 May 1855, which is printed in the *Journal of the Royal Geographical Society*, Vol. 25, pp. v and vi.

"The duty of submitting to the Fellows of the Royal Geographical Society a yearly statement of its progress and financial position has never been more agreeable than on the present occasion, when, favoured by the liberality of Her Majesty's Government, the Council is at length enabled to hold the Anniversary Meeting of the members of the Society in their own house, and in apartments befitting the importance of their pursuits. . . .

"At the last Meeting the President had the satisfaction of announcing that Her Majesty's Ministers had decided to recommend a yearly grant of £500 in aid of the operations of the Society, and for the purpose of rendering its Maps and Charts available for public reference; also that the Council had taken steps for carrying out arrangements in accordance with the Treasury Minute. The results of these arrangements are now confidently submitted for approval. The Map-rooms are daily visited by intelligent strangers as well as by members generally, and the Meeting-room, Library, and other Offices afford facilities not before possessed for the collection and diffusion of geographical information. The Society's premises have undergone considerable alteration; and although a large expenditure has been unavoidable in making the necessary arrangements, it is very gratifying to the Council to be enabled to state that the funds required for such purposes have been provided from the ordinary resources of the Society, and that every account has been duly discharged.

"The Balance-sheet of the past year, accompanying this Report, shows a continued improvement of income under each head of receipt; whilst the expenditure, including a large portion of outlay for the new house, has not exceeded the estimates submitted at the last Anniversary.

"The Auditors, after examination of the Society's accounts, testify their satisfaction at the evidence, thereby afforded, of the zeal and ability with which the duties of Secretary, in regard to the financial arrangements of the Society, have been discharged by Dr. Norton Shaw, and the diligence and good conduct of the officers engaged under his superintendence and direction."

ECOLOGICAL STUDIES IN THE WEST HIGHLANDS

WEST HIGHLAND SURVEY: An essay in human ecology. Edited by F. FRASER DARLING. *Oxford University Press*, 1955. 10×6 *inches;* xvi+438 *pages; maps and plates*

GEOGRAPHERS WILL WELCOME this report since it is based on first-hand and very detailed field work in the West Highlands on the part of Dr. Darling and his colleagues: moreover, as its sub-title states, it is an essay in human ecology.

Slight acquaintance only with the islands and western highlands of Scotland is apt to provoke suggestions for a whole series of remedies for their greater prosperity—particularly those of improved communications and greater amenities for tourists. It is true that these are both important matters, but they need study against the whole physical and social background. It is too easy to assess all West Highland problems from the scale of values in other parts of Great Britain. Thus remoteness, as is very rightly pointed out, does not exist unless one is anxious to leave the place where one is. Better roads may indeed bring more goods and tourists into an area, but in other respects they may affect a crofting community adversely. For example, anyone familiar with west coast provisioning knows that he will seldom if ever get bread made locally: the tasteless loaves come from Glasgow. The past winter and the many comments in the press on rural improvidence have shown clearly how completely dependent are many of the crofters on modern road transport for essential supplies. It is true that the expense of laying in winter stocks is in part an explanation, but the fact remains that existing transport has had demoralizing as well as good effects. Along one loch in the north-west, there is a road on one side only: on that side almost all supplies are imported. On the other side there is no road and inaccessibility appears to strengthen self-reliance and self-sufficiency. Yet this side now begins to clamour for its road. Tourism, also, has its part to play in rehabilitating the highlands, but West Highlanders have yet to learn almost all the art of being hotel keepers. Accommodation is insufficient and often poor. Hotels tend to be meagre in their appointments and it is hard as yet to think of the crofter adapting himself to paying guests. And even if this new approach to the tourist were achieved, the problem of the short holiday season would remain.

The present condition of the Highlands and Lowlands has its roots in the past and the survey rightly begins with a short historical summary. The clan system survived up to the time of the second Jacobite rising although it was then perceptibly weakening before the northward move of the Border pastoral farmers. The clan system of the north is often wrongly confused with the feudal system of the south. The latter is based on the individual ownership or tenure of land and the accompanying rights of jurisdiction. The former is derived from the personal relationship between the chief and the members of the clan and has a much less precise territorial basis. It is in the description of the decay of this system, the scattering of the clans, the continued deforestation and the change in the character of pastoralism that the presentation of the historical side becomes, perhaps, so much summarized as to be misleading. The reader should be careful to remember throughout that the survey concerns the western Highlands only. Even so, just one or two sentences recalling in the central and eastern Highlands the vigorous afforestation of the Duke of Atholl on Tayside in the early eighteenth century, and the survival of the great Black Wood of Rannoch until the Second World War, would serve to make more emphatic the peculiar problems of Dr. Fraser Darling's area *within* the Highlands. Samuel Johnson certainly noted the contrasts in planted and unplanted hillsides in the 1770's. In this section, also, a short comment on the incoming of the Australian wool would be pertinent, for it served to encourage the abandonment of land by the sheep farmer to deer forests.

Then again, the steady, unquenchable, southward flow of population is rightly a central and depressing theme of the study. But a short paragraph should point out the complementary circumstances. The growth of mining and manufacture in the central trough was very close: the relationship of Scotland and Ireland to the possibilities of settlement in the New World was unique. The destination of emigrant Scots is no part of the study nor should be, but that "destination" in two senses existed, needs a brief mention.

Although the study sets a new standard of detached and critical analysis of a Scottish problem, it remains in line with many others in its rather introvert approach to the western Highlands. The pressure on the land in highland Europe in the late eighteenth and early nineteenth centuries is a continental theme in human and historical geography which awaits comprehensive and analytical study. It belongs to Piedmont and Switzerland and the Carpathians as well as to Scotland. Malthus studied it gloomily in Sweden and could not foresee there the peculiar northward trend of activity provoked first by the timber companies and later by mining. None of these themes can be justifiably pursued at length in the 'West Highland Survey,' but the reader should see the work of this team as part of a great study of human movement from highland to other habitats.

It is true enough, however, that there emerged from these stresses a rural population which had no counterpart in Great Britain. The crofting township is an agglomeration—or scatter—of homes belonging to people of similar interests and accomplishments with a strong sense of interdependence and with no class distinctions. The Gaels in them are extremely sociable. To the visitor from the south the townships may appear unattractive and untidy; few have the shelter and amenity of trees. The Report contains much factual material about differences in the nature and details of these townships over the large area under survey, and there are some shrewd comments about their siting in relation to railheads and markets

Fundamentally, Dr. Fraser Darling has published a first-rate piece of work, a genuine essay in human ecology. Perhaps one of the most interesting chapters is that on ecology and land use. It contains an important group of topics: geology and glaciation, peat formation, tree growth, biological influences, the effects of heather-burning, erosion, the status of deer, and nature of the *machair*. Those who know Dr. Darling's work need no further assurance of the authority and clarity of this section. The long chapter on relief and land forms is also most useful, and gives an excellent account of the many regions composing the area; and correlates the geology and physiography with the vegetation cover.

After a careful analysis one important conclusion emerges—that neither geologically nor physiographically can the Highlands withstand deforestation and maintain their productivity and fertility. Deforestation, in fact, largely explains a devastated countryside. This in its turn accounts for a sparse population growing sparser—unless conservation can improve living conditions, once more an economic problem.

At the end of the volume comes the Coll Report—the outcome of a discussion between specialists on a small island area. Coll presents many difficult problems, some of which are common to the greater areas previously discussed. The island has passed through a very difficult time and is far from rehabilitation. Urgent measures are necessary if further depression is to be checked.

The book is illustrated with numerous useful tables and diagrams: more would have been included had costs permitted. It would have been helpful if the lists of tables and diagrams included page numbers on which they occur. It is a great pity that costs of production did not allow greater use of photographs, for this is a theme in which photography can play an important part. Dr. Darling and his team are to be congratulated on the completion of an extremely competent and interesting piece of field work, which, if properly used, should be of immeasurable value not only to students but also to government, both central and local. J. A. and H. G. STEERS

THE AFRICANS' WAY OF LIFE

ETHNOGRAPHIC SURVEY OF AFRICA. Edited by DARYLL FORDE. *London: International African Institute.* 26 vols. 1950–54. *Pages vary,* 72 to 198. *Maps. Prices from* 7*s* 6*d* to 16*s.* Two vols. published for the Institute by *Presses Universitaires de France:* LES BAMBARA, 1954. 123 *pages,* 700 *fr.;* LES SONGHAY, 1954. 100 *pages;* 600 *fr.*

EVEN BEFORE the geographers had filled up the empty map of Africa another exploration was beginning—that of the Africans' way of life. During a century and more, observations have been recorded by travellers, officials, missionaries and, in the later years, by men and women trained in the techniques of research. The abundant material is in large measure scattered in journals, government and missionary archives and unpublished manuscripts, as well as in monographs. It was time for all this mass to be sifted, coordinated and presented in a systematic manner. This is the huge enterprise that the International African Institute has taken in hand. Some twelve other volumes are planned in addition to the twenty-eight under review. The aim (in the editor's words) is "to present a concise, critical and accurate account of our present knowledge of the tribal groupings, distribution, physical environment, social conditions, political and economic structure, religious beliefs and cult practices, technology and art of the African peoples." The volumes follow uniformly the plan thus indicated. The full bibliographies and the excellent maps are valuable features of the series. Preparation and publication have been made possible by grants from British, French and Belgian governments. It would have been helpful if brief statements could have been given of the compilers' qualifications; some are well-known experts in their several fields and able to assess critically the information provided by others. Generous assistance has been rendered by correspondents in Africa. The contributions of Africans have been drawn upon.

For the purpose of the survey the peoples are divided geographically thus: Western (11 volumes, two in French), West Central (4 volumes), Central (1 volume in French), East Central (9 volumes), Southern (3 volumes). Some volumes deal with single tribes (*e.g.* the Swazi), others with groups (*e.g.* the Nilotes). The sections necessarily vary in value—necessarily, because the available materials are not uniformly ample, nor are they of equal quality. No claim is made that they are complete or definitive. Not the least valuable feature of the survey is that it points out the gaps that remain to be filled. Apparently the general intention is to present the indigenous culture apart from changes resulting from the impact of alien civilizations. This is explicitly stated by J. F. Middleton in his account of the Kikuyu. He sets out to describe them "as they seem to have been traditionally, omitting effects modern developments have had on them." When he says that he deals with "purely ethnographic material" he seems to exclude from ethnography such reactions against westernism as Mau Mau. It is admitted that this procedure is not ideal: it results "in some distortion." The compilers are aware of the new strains and stresses in African society caused by the introduction of foreign elements; aware, too, of the disintegration that follows, but this is not their theme. Thus Mary Tew tells of the impossibility of fully reviving the traditional constitution of the Ngonde because "the religious beliefs which supported it have been superseded." The native rulers are no longer believed to control the rain and the health and fertility of their people, so they stand or fall by the performance of their secular duties alone. In contrast with this the Swazi native council ruled that the conversion to Christianity of the king's mother (*indlovukati*) would be incompatible with the similar ritual duties of her position. The substitution of bridewealth for marriage by exchange leads to marital instability among the Tiv of Nigeria, and this kind of consequence of change is frequently alluded to; but for full treatment of

this subject we must look, not to this Survey, but to the Institute's notable 'Survey of African marriage and family life' (1953). Portuguese assimilative acculturation has had great effect in Angola, we are told, but no particulars are given. In the Ilorin province of Nigeria the indigenous form of local government has generally been replaced by that of the Muslim conquerors, though some elements of the old system have been fitted into the new: we are not told more of the cultural effects of Islam and only the old deities are named. There is a brief reference to British administration among the Yoruba, and a single sentence regarding the Christian mission; that potent instrument of cultural change, the modern school, is not mentioned, and the reader is left unaware of the existence of the University College at Ibadan. It is ungracious to complain of what is missing from this abundant feast of good things; but a description of Africans-as-they-were and not of Africans-as-they-are-becoming is an incomplete banquet. We are left to speculate upon the Afro-European culture that is perhaps emerging in the new Africa. To do justice to that theme would require another survey based upon this one, and equally voluminous. EDWIN W. SMITH

REVIEWS

EUROPE

CORNWALL. By W. G. V. BALCHIN. *London: Hodder & Stoughton*, 1955. 9×7 *inches;* xii+128 *pages; maps and illustrations.* 16*s*

This book sets out to explain the existing landscape; and the author points out at the beginning that this landscape is un-English, retaining many features arising from an isolation which lasted right up to the Railway Age. The Cornish scene is the visible result of some 4000 years of man's impact on a distinctive physical background, and the author rightly stresses the importance of both influences. All landscape features are dealt with—the settlement and field patterns, the prevailing types of walls and hedges, churches, chapels, wayside crosses, the castles, manor houses, towns and industries, together with their linking pattern of communication. And throughout the descriptions of these features the influence of the physical setting and the remarkable continuity of Cornish culture are kept in mind.

This, however, is quite a small book and the result is ambiguity on certain points. For example, the existence of some nucleated villages with open-field systems is illustrated—a good point, in that it shows how rare the completely isolated culture and economy really is. But it is possible in reading this work to get a false impression of the extent and importance of this feature which is, after all, foreign to Cornwall. More serious is the inadequacy of the account of settlement and field patterns, for both these could have been explained more satisfactorily if Cornish agriculture had been allotted a little more space. As it is, the differences between Cornish and Midland settlement patterns are noted but hardly accounted for, whilst any explanation of derelict and semi-derelict enclosures in terms of miner smallholders, climatic deterioration and changing economic conditions is only half the story. The other half could be found in an examination of local agricultural practice which could justifiably be included in even a small book, because it would emphasize more than anything else that continuity of theme which is rightly stressed elsewhere.

Professor Balchin's book is neither a geographical nor a historical text-book, but rather a companion to the discerning traveller. As such it should not be expected to cover fully any particular aspects of Cornish geography or history. More detail on agriculture would have improved the work only because it would have thrown light on a feature of the landscape which always puzzles the enquiring visitor to the interior

of Cornwall. In explaining other parts of that landscape, the author gives just the right amount of detail. His photographs and maps are well selected to illustrate the text, and if his writing is not quite so devoid of sentiment as the editorial introduction would have us believe this is all to the good, for a touch of sentiment in discussing 4000 years of unique development amounts to a true appreciation. N. H.

THE COTSWOLDS, by EDITH BRILL, and THE VALE OF PEWSEY, by H. W. TIMPERLEY. *London: Robert Hale, 1955 and 1954, 8½×5½ inches; xvi+241 and x+230 pages; sketch-maps and photographs. 18s each*

Designed for the layman rather than the professional geographer or amateur of local history, these two volumes in the Regional Books series are written in a popular and not too technical style. Generously illustrated with excellent photographs and crammed with a wide variety of miscellaneous information they provide pleasantly superficial accounts of two attractive regions.

The Cotswold volume is chiefly concerned with "human activity, past and present, . . . although to this the natural scene and its natural history come close in interest." Indeed, the physical background receives scant mention save for a brief and misleading reference in the introduction. Chapters dealing with the prehistoric and Roman periods are followed by others concerned with later developments in various parts of the area and the pages are filled with accounts of megalithic monuments, folklore, rare plants, the architectural features of parish churches as well as with details of the Cotswold woollen industry, the working of local stone and the growing of tobacco at Winchcombe. Two unfortunate misprints should never have been allowed to slip through. The light Roman plough is, correctly, *aratrum* (p. 15), while the quotation from Mrs. Sturge-Gretton's 'Burford Past and Present,' should read "burgage houses" (p. 154).

The second book attempts "to portray the character and catch the spirit" of the Vale of Pewsey and, in the first chapter on the region as a whole, a certain felicity of description combined with a "feel" for the country does conjure up a picture of the area in the mind's eye. But the book is overloaded with descriptive passages—of wayside flowers, of birdsong and of fleeting rainstorms; and one could wish them shorter or that, instead, more matter had been added to the chapters on roads, the Kennett and Avon Canal, the White Horses and the local antiquities. Descriptions of churches, mills and manors, of footpaths and ancient trackways; tales of local fairs and feasts and of the region's links with King Alfred; histories of local worthies, such as Pewsey's tragic poet, Simon Duck, all add interest to the narrative.

Sketch-maps in both volumes show most of the places named in the text, but are designed on antique lines, the uplands appearing as a series of molehill-like mounds. These could have been replaced with advantage by physiographic diagrams, losing thereby nothing in accuracy and gaining in verisimilitude. The maps, in effect, emphasize the meagre attention paid to the physical environment. This important criticism apart, both volumes provide reasonably accurate and pleasantly readable material for the unexacting. A. M. L.

A GEOGRAPHY OF EUROPE. By JEAN GOTTMANN. Revised edition. *New York: Henry Holt, and London: George G. Harrap, 1955. 9½×6½ inches; xii+724 pages; maps and plates. 50s*

This well-known text, written for American students, now contains revisions made necessary by the events of the last five years and some new and redrawn maps, although only a close comparison with the text of the first edition would make clear what has been added or changed.

Merits of this book derive from the consideration of the whole continent by one mind, from its readability despite occasional concessions to American phraseology, from its pleasing illustrations, its attention to historical factors and stages of development, and the author's broad conception of "human geography" which lies nearer to

that of Demangeon than to that of De Martonne. Among the new maps provided, those tentatively offered to show the consumption of food, energy and artificial fertilizer based on 1951 data (pp. 87–8), invite notice and reflection. After a short introduction, the book deals in turn with Western, Central, Mediterranean, and Eastern Europe. The demarcation of these divisions shows certain distinctive features: "Northern Europe" as such disappears, Sweden and Finland being allocated to Central Europe; Yugoslavia is grouped with Mediterranean Europe; Eastern Europe becomes European U.S.S.R., now a common equation.

Even a competent survey of a whole continent such as Professor Gottmann's inevitably invites discussion and critical comment. Can the relatively restricted space allotted to European U.S.S.R., knowledge of which American students particularly need, be now excused on the ground of "paucity of reliable and detailed information" (p. vi), the more so since the antithesis between East and West in Europe is continually stressed? The treatment of physical geography appears slight: is this a desired easement for American readers? While good use is made of selected statistics in the text, the provision of tables, which can summarize with brevity and precision so many facets of European demography and economy, would have seemed desirable. No lists of maps and plates are provided to facilitate reference. Some of the author's judgements arouse discussion—as doubtless they should. Did the Treaty of Verdun of A.D. 843 really divide Western Europe into "clear-cut cultural areas" (p. 66), for it certainly sliced in three the area of Frankish settlement? While there is interesting reference to "underdevelopment," the dubiously alleged "overpopulation" of parts of Europe (pp. 90–3 and 683) deserves clearer analysis, for this is more an economic than either a psychological or geographical concept. The comparison of sheep and wool in U.S.S.R. and Australia (p. 623) is surely explained by reference to population numbers and climate, and it is the Lord Chancellor who sits on the Woolsack (pp. 214–15). W. G. E.

CHANGING LAPPS. By G. GJESSING. Monographs in Social Anthropology No. 13. *London School of Economics*, 1954. $7\frac{1}{2} \times 9\frac{1}{2}$ *inches;* 67 *pages; maps.* 12*s*

Since the time when Ottar visited King Alfred, the Lapps have made an impact upon Britain out of all proportion to their numbers. All "Lappologists" (as K. B. Wiklund christened them), will applaud Dr. Gjessing's richly factual yet most readable "study of culture relations in northernmost Norway." It is for the most part the substance of a number of lectures recently given in London: it will be the more appreciated because it adds to the literature in English a statement from Norway to set beside 'The Lapps' of Björn Collinder (1949) and the official 'Finnish Report on Lapp Affairs' (1952).

'Changing Lapps' calls for a revision in established ways of thinking about this community of 33,000 people. First, they do not like to be called Lapps: they ought to be called by their proper name *Samek* (Norwegian, *Samer*). Next, the romanticized reindeer herders are an occupational minority within the Lapp group. Thirdly, the blossoming of their nomadism is regarded as something of relatively recent origin—perhaps as recent as the sixteenth century. Their changing order of life results from the replacement of a self-sufficient economy by a commercial economy, the introduction of a new range of techniques (from plough and tractor, through automobile and slaughterhouse to snowmobile and radiotelephone) and the profound disturbance of the war years. Dr. Gjessing analyses the change in relation to three different groups: Laksfiord, a sea—*Same* community in transition: Karasjok, a permanent inland settlement of *Samer*: Kautokeino, a stronghold of reindeer nomadism. The contemporary disharmony between Lapp and Norwegian and the disintegration of kinship loyalties in Lapp communities are the more fully understandable as a result of Dr. Gjessing's description of earlier culture contacts and of Laestadian revivalism.

The monograph is another happy tribute to the liaison between the London School of Economics and "The Northern Countries." W. R. M.

ASIA

THE OLD TURKEY AND THE NEW. By Sir Harry Luke. *London: Geoffrey Bles*, 1955. 6½×4 *inches;* xi+243 *pages; illustrations.* 16*s*

A good deal has been written about certain aspects of Turkish history but as yet very little in English that covers the whole period from ancient times to the present. Sir Harry Luke has done something to correct this in a book which is a series of historical essays on certain aspects of Turkish society. It takes a restricted field of Turkish history and deals effectively with it.

The author has travelled in Turkey since 1904 and held various political and diplomatic offices in the Middle East. He begins with the fall of Constantinople and makes it a point in his treatment of this period of Turkish history that Turkey inherited the *millet* system from the Byzantine Empire, and that this was one of the causes of its later weakness. These culturally independent communities each had their own religion and language. The Sultan was the head of the State but also of the various churches and religions of the Empire. The Mahommedan Turks were also a *millet* and indeed a minority on whom rested the burden of defending the Empire and bearing the sacrifices in all its wars.

The author traces the various attempts at reform in the Ottoman Empire from the Tanzimat Reforms to the 1908 Young Turk Revolution. Progress was slow and the idea of social and political equality among the various races and religions of the Empire hard to carry out in practice. The Moslem Turkish *millet* bore the burdens of military service; the Christian *millets* were exempt, but had to pay heavy taxes. Yet the Christians did not want to give up their position and accept full citizenship. They were much influenced by the Western Powers, particularly Russia, and started territorial claims for independence. On this the Young Turk Revolution foundered. As the author says: "Had the Young Turks had more time at their disposal, they might have made something of a bad job. But time was against them."

The last five chapters deal with modern Turkey as far as law, language, administration and religion are concerned. The Turkish language, Sir Harry thinks, will come into its own again, thanks to Ataturk, now that Arabic and Persian words are excluded. As far as spiritual life is concerned he thinks that the dethroning of the Moslem sacred law and the secularization of the State has caused religion in Turkey to "ascend into the stronghold of conscience." The General Election of 1950 was the landmark in modern Turkish history. The Democrats have let in a freer atmosphere and have abolished those totalitarian features of the system immediately following the National Revolution. But without Ataturk's strong authoritarian rule modern Turkey might never have emerged from the chaos that followed the First World War. M. P. P.

EVEREST: A guide to the climb. *London: University of London Press*, 1955. 7×5 *inches* (*folded*). 1*s* 6*d*

The sub-title to this ingenious pamphlet is at first sight misleading: what we have here is not a guide in the sense of instructions on the best way of getting to the top of Everest, but a pictorial chart showing the stages in the complicated movements needed to put two people in position to attempt the final assault on the summit. It shows, graphically and clearly, the position of the expedition through April and May 1953 and is correct in all details. From it may be seen, at a glance, how seven weeks were occupied in the ascent of Everest, from the base camp at 17,900 feet, and only two days required for the descent. The chart certainly helps to make intelligible the comings and goings of thirteen climbers and some thirty Sherpas and should be a useful companion to those who wish to study the ascent more closely. The guide also contains a map of the mountain with the route from Base Camp indicated, and a diagram of the camps on the Lhotse face. There are notes on the geographical features, a diary of the climb and biographical notes on the climbers. Most of the notes are covered in Sir John Hunt's 'Ascent of Everest,' but the chart of the climb is not, and the whole production is a most useful one-and-sixpence worth. W. G. L.

AFRICA

LAND TENURE IN BASUTOLAND: Colonial Research Studies No. 13. By VERNON SHEDDICK. *London: H.M.S.O.*, 1954. 6×9½ *inches;* 196 *pages; maps and plates.* 25*s*

This study represents the results of a survey undertaken during 1947–9 into various aspects of present land tenure in Basutoland and its historical evolution and significance. The project was sponsored by the Colonial Social Science Research Council. Though it is primarily a sociological and anthropological study, much of it reads like a human geography of Basutoland. The "ecological approach" is used to assist in analysing the anthropological problem of Basuto land tenure particularly where this in turn is related to the availability and optimum utilization of natural resources. Malinowski's words that "Land Tenure is above all the relationship of man to the soil in the widest sense," are quoted by Dr. Sheddick whose treatment of the geographic elements in the whole picture he presents is both satisfying and significant. "The Socio-ecological Setting of Land Tenure in Basutoland," "Land Use and Land Holding," "The Structure of Land Tenure," and a conclusion divide the book into four parts. Individual chapters on geographical opportunity, settlement and residence, crop production and annual husbandry and land tenure, and the concluding one on land shortage indicate the valuable addition this book is to the geographic literature on the structure and pattern of African settlement. But it would be wrong to single out specific chapters without reference to the whole work. It is the problem of land tenure in Basutoland as a whole that is important and this well-balanced survey adequately discusses the manifold factors that must be reckoned with. The book is illustrated by a number of excellent photographs including air photos of arable field patterns and by generalized maps of land utilization and major natural regions.

T. J. D. F.

COCOA. By D. H. URQUHART. *London: Longmans* (*Tropical Agricultural Series*), 1955. 8¾×5½ *inches;* xix+230 *pages; maps, diagrams and photographs.* 35*s*

This is the second volume in a valuable series on tropical agriculture and its crops. Mr. Urquhart is well qualified to write on cocoa, as for many years he was in the Agricultural Departments of Nigeria and the Gold Coast and, before retiring, was Director of Agriculture in the Gold Coast, the world's largest cocoa producer. Since 1950 he has also visited most cocoa producing countries. The author has drawn on this varied experience, and other experts from East Malling and the Imperial College of Tropical Agriculture have contributed chapters. Geographers will be most interested in the chapters on the history of cocoa, its botany, the climate and soils it requires, production areas and consumption trends. The book is very well illustrated with photographs and diagrams, though the two maps are poor.

Cocoa is not grown north of about 8° N. in West Africa, contrary to what is implied on pages 7 and 17. Reference should also have been made to cocoa plantations in the Ivory Coast, the Cameroons, Fernando Po, São Tomé and Príncipe, and their contrast with peasant production almost everywhere else in West Africa. Nor is there reference to the surveys by R. W. Steel of Ashanti cocoa villages. There are several errors concerning the history of cocoa in West Africa. The Dutch partially occupied São Tomé only from 1641 to 1644, not until 1844 as mentioned on page 2. Nor did they introduce cocoa to the island, this having been done in the nineteenth century. Cocoa beans were introduced to the mainland not from São Tomé but from Fernando Po (*cf.* pp. 2 and 98). Seedlings were afterwards introduced from São Tomé by the Gold Coast Government (*cf.* p. 4). Nevertheless, the study is not historical but essentially a manual for planters and merchants. As such it is excellent, and a most elegant and refreshing change from the usual dreary manuals on commodities.

R. J. H. C.

INTO THE BLUE. By LIONEL FERGUSON. *London: Collins*, 1955. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 255 *pages; maps and photographs.* 16*s*

'Into the blue' is an account of the Lake Tana expedition, 1953, which was undertaken by a party of five undergraduates from Cambridge. Three were geographers, one an historian and one an economist. The expedition did not lack ambition, its object being not only to motor to Lake Tana in the Abyssinian Highlands and back during the long vacation, but also to make a survey of the Dembea District north of the Lake. As this survey was to include studies of land use and settlement patterns, customs and religion, and physical geography with special attention to the theories on the origin and formation of Lake Tana; and as several other tasks were added, varying from the location and assessment of building stone and rumoured lignite deposits to the collection of moths, beetles and butterflies, one cannot accuse the author of overstatement when he says, on arrival at Lake Tana, "With only a fortnight to complete all our work, it was obvious that we were going to be busy."

The greater part of the book is taken up with the journey to and from Lake Tana. Mr. Ferguson gives a light-hearted and amusing account of the difficulties which cost the expedition valuable time on the way out, and it would be difficult to read his narrative without wanting to travel in his tracks. There is a useful appendix listing the equipment taken. The photographs are up to standard. J. M. R.

NORTH AND SOUTH AMERICA

SYMPOSIUM ON THE GEOGRAPHY OF PUERTO RICO. Edited by C. F. JONES and R. PICÓ. *Río Piedras, P.R.: University of Puerto Rico Press*, 1955. $9 \times 5\frac{1}{2}$ *inches;* xxviii+503 *pages; maps, illustrations, diagrams*

This symposium of papers on the geography of Puerto Rico is published under the auspices of the Social Science Research Centre of the University of Puerto Rico, in cooperation with the Puerto Rico Department of Agriculture and Commerce, the Puerto Rican Planning Board, and the Department of Geography of Northwestern University. It is but one interesting outcome of a three-year programme of land classification commenced early in 1949. The editors, in their preface, describe the steps which led to the survey which was initiated by the Planning Board of Puerto Rico in association with the Geography Department of Northwestern University. Subsequently graduate students from nine other American departments of geography participated in the project which was aided by a substantial government grant. The total cost of the programme is set at $146,000. To date no other territory in the Caribbean has been surveyed in such detail—it is greatly to be regretted that nothing comparable has been accomplished for even one of the several British dependent territories in the area—and the editors can justly claim that "the scope and extent of the field work involved" has not been "matched elsewhere in the Tropics."

The present volume contains eighteen essays, each on some aspect of the rural scene in Puerto Rico; all but two of the nineteen authors took part in the field work. Each chapter merits praise for its freshness and for the wealth of new information that is made available in palatable form.

British geographers will find of particular interest the contributions of: D. R. Dyer, "The Pilot Survey: The Development of Survey Techniques for the Rural Land Classification Program;" R. N. Young, "A Geographic Classification of Landform Types of Puerto Rico;" D. G. Montoya and H. H. Berrios, "Uses Made of the Data Obtained in the Rural Land Classification Program."

The essays of J. P. Angelli and J. F. Lounsbury on types and patterns of rural settlement are most informative. The writings of the other authors deal with the agricultural geography of the island. Outstanding among these would seem to be W. W. Burchfiel on "The Pineapple Industry," but each in its particular way is a contribution to knowledge.

The symposium is well illustrated by maps, diagrams and pictures. Finally, attention must be drawn to the thirteen folded maps in the back pocket. Anyone interested in Puerto Rico or in the development of tropical areas will find close study of these most rewarding; they form in miniature a "national atlas" of Puerto Rico's rural scene.

E. M. J. C.

AUSTRALIA

ANCIENT AUSTRALIA. By CHARLES F. LASERON. *London: Angus and Robertson*, 1955. 9×5½ *inches;* 210 *pages; maps and plates.* 21*s*

THE FACE OF AUSTRALIA. By CHARLES F. LASERON. *London: Angus and Robertson*, 1953. 8½×5¼ *inches;* xii+244 *pages; maps and illustrations.* 18*s*

Mr. Laseron will be remembered by many as the author of 'South with Mawson' (London, 1947). In 'Ancient Australia' he has achieved an outstanding success in presentation, for he has not only compressed the geological history of the continent into less than two hundred pages, but has also written a general introduction to geology for Australian readers in comprehensible language without interrupting the continuity of narrative or losing sight of the rest of the world. The success has been achieved at some cost, of no consequence to the ordinary reader who wants a reliable explanation of how the Australian continent came to be what it is; for, within the dogma of the permanence of ocean basins, the book is consistent and its argument valid. There are, however, two rival hypotheses: that of Wegener, who maintained that Australia is a remnant of continental drift, and that of Schuchert, who would have it a remnant of a much larger mass which has not drifted. Schuchert announced his hypothesis in 1916. W. H. Bryan, in the Clarke Memorial Lecture for 1944, said: "Such a startling statement, from one who was already recognized as a world authority on stratigraphy and palaeogeography, would, one might expect, have caused a sensation in geological circles in Australia. It did not, as far as I can gather, create even a ripple. The basal philosophy underlying the interpretation of the growth of a continent had been turned topsy-turvy—and apparently nobody cared. At least there was no immediate reaction expressed in the printed word." Laseron is so well versed in the geological history of Australia that a short statement on other philosophical views than his own would have enhanced his authority. This volume is, nevertheless, a most welcome contribution to popular scientific literature about Australia. In his earlier book, 'The Face of Australia,' he traces the history of the landscape, but less successfully than he traced the geological history of the continent. The writing is less practised than in the later book and the presentation not so incisive, perhaps because geomorphology offers no such ready-made framework as the geological record for the marshalling of the arguments. But this book too is a source of first-hand information about Australian scenery, and the earlier chapters, on the evolution of the bush, communicate the feeling of the country in a convincing way. Both books have an unpardonable fault. The plates, though excellent, are not numbered. The name of Mt. Mann, mentioned on pp. 60 and 243 of 'The Face of Australia,' should read Mt. Hann.

M. A.

PHYSICAL AND HUMAN GEOGRAPHY

ENERGY IN THE FUTURE. By PALMER COSSLETT PUTNAM. *London: Macmillan*, 1954. 9¼×6¼ *inches;* x+566 *pages; maps, tables, diagrams and illustrations.* 90*s*

This is an important book and all serious economic geographers will wish to have it on their shelves. Indeed, it should appeal to a far wider public for its subject matter is of transcendental importance and the fact that it was written by a distinguished consulting engineer at the request of the United States Atomic Energy Commission, as a background study for the Commission's consideration of "economic and public policy problems related to the development and use of machines for deriving electrical power from nuclear fuels," is indicative of its reliability. The argument is clearly

presented throughout and impressively buttressed with a wealth of factual data of all kinds.

In his opening chapter Mr. Putnam poses the question: What is the maximum plausible quantity of energy that people might demand in the next fifty years or so? This he seeks to answer in the light of available evidence concerning population growth and on the assumption that the present world-wide movement to "replace illiterate subsistence farming with literate industrial-urban-farm patterns of life" will continue. As a working hypothesis he assumes a maximum plausible population for the year 1975 of 225 million in the United States and 2900 million in the world as a whole; corresponding figures for the year 2000 are nearly 300 million and 3700 million respectively.

But while population continues to grow, the world's "capital" reserves of energy are being consumed at a prodigious rate. Since 1920 the United States has burned one-half of all the coal ever consumed, and nearly half of all the oil and gas consumed has been used since 1940. After a detailed consideration of possible improvements in the efficiency with which energy is used, and a thorough examination of known and probable recoverable reserves of coal, oil, gas, etc., Mr. Putnam concludes that, if the United States is to avoid the risk of seriously increased real unit costs of energy, new low-cost sources will be needed on a major scale by 1975 or even sooner. The same conclusion appears to hold good, broadly speaking, for the world as a whole.

So far as major increases from "income" sources, notably fuel wood, water power and solar energy, are concerned the author is not very optimistic. Thus, while recommending further exploration of ways to obtain energy from sunlight in more useful forms and at lower cost than now appears possible, he turns in his final section to consideration of the more encouraging prospect of nuclear energy. Here he has many arresting things to say. Nuclear fuels may well prove capable before very long of competing with present coal costs in the generation of electricity, but a major drawback is their unsuitability for sustaining more than about 20 per cent. of a total energy system so long as its pattern approximates to that of the main industrialized western powers today. Thus it may be that countries as yet not heavily committed to such patterns of energy consumption will find it easier to make the transition to nuclear fuel on a major scale.

Whether this proves to be the case or not, however, it seems clear that the compelling need which must soon arise throughout the world for new sources of abundant low-cost energy will make it expedient for all forward-looking nations to undertake rigorous investigation of the potentialities which nuclear energy may afford. The relevance of this argument to our own problems in Great Britain must surely be self-evident. C. A. F.

THE EARTH BENEATH US. By H. H. SWINNERTON. *London: Frederick Muller*, 1955. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 320 *pages; illustrations and diagrams.* 21*s*.

This is not a text-book for students of geology but it will still find a fitting place in their libraries, since it sums up the penetrating experiences and emergent philosophies of an eminent man whose long life has been devoted to research and teaching in geology. It is a book which will delight the layman and will provide him with a stimulating insight into the processes of planetary formation, and the evolution of life on this earth of ours. Many attempts have been made to produce such a book during the past two or three decades, but none will match up to the clarity of style, the sense of the dramatic, or the authenticity of the contents of this truly remarkable book.

The author presents this earth not as a place where man merely gets a living, but where he should find enjoyment and companionship, and the mere contemplation of the beauty of nature adds to that enjoyment. For more than twenty centuries there has been a succession of men who have gone further, and have found happiness in studying nature: the positions of the stars, the place of the earth among the heavenly hosts, the movements of the seas, the rocky foundations of the earth, the plants which

garnish the scenery, the animals and birds which play their parts upon that stage. In recent centuries these students have extended their enquiries into the how and the wherefore of it all—how and when the earth was born, how rocks were formed, valuable ores deposited and mountains reared up. In the rocks they found the trail left behind by climates that were changing through the ages, the remains of plants and animals that played their part in primeval seas and on ancient lands. They traced the growth of type from type and eventually came upon the tracks of their own forerunners. These latter they followed until man himself appeared and began to change the scenery and modify it to his own ends.

It is this thrilling story the reader will unfold, for this is a book which no reader will fail to read from cover to cover—only pausing to enjoy the beautiful illustrations which so aptly punctuate the text. W. D. E.

MAN AND THE LAND. By L. DUDLEY STAMP. The New Naturalist Series. *London: Collins*, 1954. 8½×8 *inches; 272 pages; maps, diagrams and plates.* 25*s*

The author's earlier volume in this series, 'Britain's structure and scenery,' set the scene for a discussion of the modifications of a natural landscape by man. Some years ago Professor P. W. Bryan published his book 'The cultural landscape' in which he discussed the picture of our landscape as amended by man's activities. Professor Dudley Stamp confines his attention to the rural, indeed largely to the agricultural, landscape rather than the cultural landscape in its wider sense. He develops the picture by describing its evolution through time from the Ice Age to the present and concludes with a chapter on the future. As the author himself says, a subject of such scope must involve the omission of much and that omission invites criticism. It is on the wisdom of the selection that such a book must rely for its success and this volume exemplifies Professor Stamp's powers in this respect. Among the many attractive features of the book one is struck by the author's inclusion of several topics not always given attention as part of landscape. The evolution of our livestock breeds is summarized in a lengthy and well illustrated chapter and a discourse on the trees to be found, many of them introduced from overseas, serves as an introduction to a consideration of our woodland and the relatively youthful development of plantations.

The reader is tempted to seek omissions or errors and in a work of such scope these are bound to occur. There is an unfortunate transposing of the captions to Figures 8 and 9. Some might criticize the somewhat scant attention awarded to actual changes of land use but such should recall the author's well known work 'The Land of Britain: its use and misuse,' from which he has reproduced several illustrations.

This story of the evolution of our cultural landscape is told in attractive style and the illustrations, whether in colour or in black and white, are well reproduced and apt. In addition, a considerable number of maps and diagrams are used to illustrate the theme. H. C. K. H.

MAP AND LANDSCAPE. By D. SYLVESTER. *London: George Philip*, 1952. 8½×5½ *inches; 290 pages; figures and plates.* 25*s*

The cartographer's art of map-making and the geographer's map interpretation of specific sheets or areas have both been ably treated in recent books: existing between them is a gap which is filled by Miss Sylvester's 'Map and landscape.' This approach to the map is as to a tool for use. The author's analysis of the "points" of the various editions, her data lists of British and foreign maps and her full colour excerpts from no less than fifteen of these, will be to the geographer what a seed catalogue is to a keen gardener—a mine of information of a specific, comprehensive and interesting nature, systematically set out, and designed towards practical ends.

The map and the field are closely linked throughout the three parts of the book. Part I, "The Grammar of Map-reading and Field Work," is concerned with mensuration in a range of guises, rendered clear by a number of simple and effective illustrative devices. Part II, "Map and Field Study of Geographical Features," advocates

systematic analysis of features ranging from land forms to conurbations. Some well-chosen examples are illustrated, and attention is given to the limitations as well as the potentialities of maps. Classifications, of settlement for instance, are listed to provide a reference for interpretation, and an interesting feature of this section is the set of seven study schemes, e.g. for valleys, or for karstic landscapes. These consist of headings and questions designed to ensure a comprehensive investigation of the map and the ground, leading from simple observation through correlation to interpretation. Part III deals with the geometrical relationships involved in constructing panoramas, block diagrams, etc. Field sketching and the selection of viewpoints also have a chapter apiece. Appendix II gives detailed advice on how to plan and organize field excursions.

It will be clear that the book has been written for teachers, who should especially appreciate the suggestions for map sets to be acquired with limited resources, but it also contains much of value for students and for any sixth-former sufficiently advanced for independent map and field-work. A. C.

MÉMOIRES ET DOCUMENTS. Tome IV. Centre de Documentation Cartographique et Géographique. *Paris: Centre Nationale de la Recherche Scientifique*, 1954. 284 *pages*

This annual production of the National Centre for Scientific Research is of interest and value to all geographers. This year it contains five important papers. P. Birot and L. S. Sabaris discuss land forms in the north-west of Spain, B. Borner deals with the relief of northern Limousin, M. Pardé summarizes recent progress in hydrology, M. Tricart takes as his theme the Quaternary history of the Durance, and A. Perpillou analyses the morphology of the Leon (Brittany) coast.

All these are long papers of high merit. M. Pardé's paper is somewhat different from the others in that it discusses recent work on hydrology in all countries. It is a most useful summary and will be of great value to all interested in rivers. The other papers will appeal more to specialists in various branches of morphology. All are well illustrated, and the presentation is good.

At the end of the volume there is a section devoted to the maps of Italy—maps not only topographical, but also illustrating particular points and reports which have, for the most part, appeared in articles and books.

There are also some pages devoted to geography in the universities of France. This amounts in brief to a list of lectures and lecture courses, and will be of interest to many people. The years covered are 1952–3 and 1953–4. The much wider range of courses at Paris is emphatic. To these lists are added the names of the students who have presented theses during these two years. The titles of the theses are given.

These four volumes have all been of high standard, and should be a welcome addition to all departments of geography and libraries. J. A. S.

CARTOGRAPHY

ORDNANCE SURVEY "TEN MILE" MAP OF GREAT BRITAIN. 1/625,000. 2 *sheets*, 32×40 *inches. Chessington: Ordnance Survey*, 1955. 4*s a sheet, paper, flat*

The Ordnance Survey has published a new edition of the "Ten Mile" map of Great Britain in two sheets. (The scale has in fact been slightly increased to 1/625,000 but the well-known title has been retained.) Considerable changes have been made in the design, with the aim of making it a good topographical map of this country. In the colours assigned to the various features, there appears little departure from recent Ordnance Survey practice: *e.g.*, built-up areas have a grey, and not a black, filling; and sandbanks are shown by brown dots. The general aim has clearly been to avoid strong colour contrasts. This has been achieved on the whole—perhaps too successfully in the layer colours for the lower altitudes. A very light green is used up to 200 feet, a light buff from 200–400 feet, and contours are not inserted. For most of

lowland England, this produces a rather formless impression, and physical features such as the scarps of the North Downs, the Chiltern Hills, etc., do not show up distinctively. On the other hand, the roads, at least in the lowland areas, are dominant. Trunk and Class I roads are in red, and other roads by double lines without a colour filling. These sometimes interfere with the rivers and railways. It would be an advantage also if canals could be distinguished from rivers. If the minor roads were shown by a narrower symbol a good deal of space would be saved: the rule appears to be that if a village is inserted, it must have its road. This probably accounts for a reduction in the number of villages included. But is it necessary to show so many minor roads? The result is that the map is primarily a good road map.

Apart from this there is little to criticize. Attractive founts have been used for the names, especially the capitals used for the counties, and the settlement names are graded in six sizes according to population. The result is a very legible name plate. The map carries the National Grid, but the 10-kilimetre squares being printed in olive green do not obtrude. Needless to add, the map is excellently printed—clean and sharp, with perfect registration. G. R. C.

THE MADABA MOSAIC MAP: with introduction and commentary by M. Avi-Yonah. *Jerusalem: Israel Exploration Society*, 1954. 11½×8½ *inches;* 80 *pages; maps, plans and illustrations*

Madaba, where the famous sixth century mosaic map is to be seen, is a little town on the old Roman road which runs from north to south through Ammon and Moab, some ten or twelve miles beyond Jordan and the Dead Sea. The author of this monograph, Michael Avi-Yonah, lecturer in Byzantine Archaeology at the Hebrew University, Jerusalem, leaves us to discover this geographical information for ourselves, assuming, perhaps, an audience familiar with the ancient Syrian world. But the present political situation made it impossible for him to visit Madaba and take a colour photograph of the pavement, so that he can merely reproduce (on half scale) the colour copy of the mosaic which was published by Palmer and Guthe in 1906. We are assured, however, that this copy is a faithful one 'save in minor details,' and the ten plates will prove of very great interest to students of cartographical conventions and symbols, since they fill a gap in what is, cartographically speaking, a veritable Dark Age. Mr. Avi-Yonah considers that the map was laid down between A.D. 542 and 565, and probably nearer to the latter date, that of the death of Justinian.

Only fragments of the map, which represents Syria, now remain, for apart from wear and tear, the ancient Byzantine church, across the transept of which it lay, has been much restored. Originally it probably measured (with its border) about 25½ metres by 7½ metres and was oriented in conformity both with the way pilgrims approached the Holy Land, and with the orientation of the church: that is to say, with eastern border towards the altar, the western towards the nave. Northwards it extended to Byblos and Damascus, southwards to the Nile delta, and illustrated the Bible story of both the Old and New Testaments. The map is based on road itineraries, but scale is related as usual to the importance of features shown, while direction is sacrificed wherever the rigid shape of the map, or the fitting in of a legend, demands it. Semi-pictorial symbols are used, those for mountains, streams, villages and towns being strongly reminiscent of the illustrations in the writings of the Roman *agrimensores*, although modified of course by the medium employed, *i.e.* mosaics. Fish swim in the large rivers, while two ferries are shown across the Jordan, and two trading ships on the Dead Sea. The latter have a single square sail and two steering oars passed through the thwarts. Unfortunately iconoclasts destroyed the heads and torsos of the steersman and pilot (or captain), although the remaining limbs (like the remaining hind-quarters of the desert lion) suggest figures of considerable artistic merit. The larger cities are realistically represented so far as their walls, main streets and prominent buildings are concerned, and the vignette of Jerusalem on this map has long been closely studied. Mr. Avi-Yonah finds evidence that, although the

language of the map is Greek, its author was a Syrian, and it may well be that the artist actually responsible for the mosaic design was using a contemporary regional map of Syria as a model. Alexandrine science still survived strongly in Syria, and was to be passed on during the next century to the Arabs.

Detailed and scholarly annotations to the plates, and a select bibliography, are among features that will prove most welcome to the student. E. G. R. T.

NATURAL HISTORY

THE WILD FLOWERS OF KUWAIT AND BAHRAIN. By VIOLET DICKSON. *London: Allen & Unwin*, 1955. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 144 pages; maps, line drawings and photographs.* 25*s*

If it is true that most of the world's deserts—including, of course, the cold polar deserts—are associated with the Pleistocene glaciation, it follows that both the arctic-alpine flora and the desert vegetation units are of recent origin. Yet it is difficult to believe that the weird and highly specialized xerophytic vegetation of conventional deserts is post-Pliocene.

One of the chief objections to the "continental drift" theory as enunciated by Wegener is that, if "Pangea" existed throughout the Cretaceous, the interior of the vast continent must for aeons have been a howling desert. Only on its extreme edges would a desert flora—*any* flora—have been able to develop; and from the Eocene onwards, conditions must have improved gradually as the continents separated. However that may be, modern deserts provide an interesting and varied flora, as Mrs. Violet Dickson's book amply demonstrates for the north-east corner of Arabia.

This is not a book for the novice hoping to identify desert plants, though the excellent line drawings will often assist him. Primarily it is a book of reference for the plant geographer and the expert field botanist interested in the desert; he can safely rely on the identifications. Professor Ronald Good has added a chapter on the flora of Bahrain.

I am tempted to say that the work would be even more useful to the geographical botanist, inexpert in the flora of the Middle East, had the plants been arranged in families. But the author must have considered this, and rejected it (possibly on grounds of expense). Perhaps a separation of Dicots from Monocots would have met this criticism. The line drawings are excellent, and well illustrate the desert type of plant. The few photographs are less successful; three of them illustrate vegetation types better than the plants specified.

The author may be congratulated on the patience, enthusiasm and thoroughness with which she has done her work, including the collecting and preservation of practically the entire flora of a small sub-desert area, with notes which any field botanist might envy. The price appears high. F. K.-W.

THE SOCIETY'S NEWS

NEW OFFICERS AND COUNCIL OF THE SOCIETY

Following the Annual General Meeting on June 20, Lord Nathan becomes a Vice-President in place of Mr. L. C. G. Clarke, who remains a member of the Council. Of the seven new members of Council, six will serve on the Council for the first time, namely Lady Tweedsmuir, M.P., Colonel F. St.J. Birnie, Commander C. J. W. Simpson, Mr. L. S. Suggate, Captain A. C. Loraine and Mr. V. W. Oelrichs. Professor Steers, Professor of Geography at Cambridge, last served on the Council from 1946 to 1952.

Lady Tweedsmuir, the wife of Lord Tweedsmuir, who served on the Council from 1942 to 1949 and 1950 to 1953, is Conservative Member for South Aberdeen. Colonel Birnie was a member of the Kamet Expedition of 1931 and of the 1933 Everest Expedition. Commander Simpson, this year's Gold Medallist, was leader of the British North Greenland Expedition. Mr. Suggate is President of the Geographical Association. Captain Loraine has a long and distinguished record of service as a pilot of B.O.A.C. and is now a senior member of the Corporation's administrative staff. Mr. Oelrichs served for many years with Cable and Wireless Ltd. in the Far East and in the Pacific.

BIRTHDAY HONOURS LIST

It was announced in the Queen's Birthday Honours List that an O.B.E. had been conferred on Mr. Leonard Brooks, the Society's Honorary Treasurer since 1953. Mr. Brooks joined the Society as a Life Fellow in 1915, was on the Council from 1934 to 1939, Vice-President from 1939 to 1946, and Honorary Secretary from 1946 to 1953. The award was also announced of an O.B.E. to Mr. Richard Hamilton, Chief Scientist on the British North Greenland Expedition.

BRITISH KANCHENJUNGA EXPEDITION, 1955

Mr. Charles Evans, F.R.C.S., the leader of the expedition sponsored by the Alpine Club and the Royal Geographical Society, arrived in London by air on Wednesday July 6. He had with him two Sherpas, Dawa Tensing (Sirdar of the Sherpas) and Changjup, and was met by Sir John Hunt, Chairman of the Joint Kanchenjunga Committee; Sir James Marshall-Cornwall, President, and Mr. Kirwan, Director and Secretary, of the Royal Geographical Society; and Mr. Emlyn Jones, Hon. Secretary of the Alpine Club.

The summit of Kanchenjunga (28,146 feet), less 5 vertical feet, was reached by two assault parties (Band and Brown; Streather and Hardie) on May 25 and 26. The news was received by *The Times*, which carried the despatches on the Expedition, on June 1, second anniversary of the receipt of the news of the successful ascent of Everest.

The story of the ascent of Kanchenjunga, third highest mountain in the world, will be told by Charles Evans and George Band at the Royal Festival Hall at a lecture open to the public on Sunday afternoon, October 2. Applications for seats should be made to the Royal Festival Hall Box Office or the usual agencies. The same lecture will be given to Fellows and Associate Members of the Society, and to Members of the Alpine Club, also at the Royal Festival Hall, on Monday, November 7, at 8.30 p.m. Public lectures are also being arranged in several provincial cities.

SPECIAL ELECTIONS INTO FELLOWSHIP

Under the Bye-Laws, Chapter III, 6, the Council of the Society is empowered to elect into the Fellowship, without subscription or entrance fee, a limited number of persons distinguished for their services to Geography and Exploration. Under this

Bye-Law, the Council have recently elected Sir Edwin Herbert, President of the Alpine Club, who was Chairman of the joint Himalayan Committee of the Society and the Alpine Club which was responsible for launching the successful Everest Expedition. He was Honorary Secretary of the Alpine Club from 1935 to 1940 and was thus also closely involved in the launching of the earlier Everest and other expeditions to the Himalaya.

SHACKLETON'S IMPERIAL TRANS-ANTARCTIC EXPEDITION

Friday 6 May 1955 was the anniversary of the day, forty years ago, when the *Aurora* broke away from her moorings in MacMurdo Sound, leaving marooned for twenty months ten men of the Ross Sea Party of Shackleton's Imperial Trans-Antarctic Expedition. This event was commemorated by a ceremony at the Society's House when the Rt. Hon. Hector McNeil, P.C., M.P., Chairman of the Encyclopaedia Britannica Company, presented to the Society the set of volumes of the Encyclopaedia which the party had with them during their months of isolation. The fly-leaf of the first volume is signed by the party, and by Ernest Shackleton himself. Professor A. Stevens of Glasgow University, last surviving member of the ten marooned men, attended the presentation, and so did Mr. and Mrs. Raymond Shackleton and Mr. Edward Shackleton, sons and daughter-in-law of the explorer. An interesting link between then and now was provided by the presence of Dr. Vivian Fuchs, leader of the forthcoming Trans-Antarctic Expedition, to which the Company proposes to present a set of the volumes of the latest edition of the Encyclopaedia. The President, Sir James Marshall-Cornwall, before thanking Mr. McNeil in the name of the Society for the gift of the volumes, gave the following address:

"Our thoughts go back today to an outstanding episode in the annals of Polar exploration; an effort which, though marked by determination and fortitude, was frustrated and robbed of its success by the forces of nature and the incidence of war. In the summer of 1914, that great Polar navigator and explorer, Sir Ernest Shackleton, prepared an expedition to cross the Antarctic Continent, a distance of 1800 miles, from the Weddell Sea to the Ross Sea. Unfortunately, the First World War broke out before the expedition had even started, and so the support and relief of the explorers was greatly handicapped. Added to that, both of Shackleton's ships, *Endurance* and *Aurora*, got into trouble in the pack ice and the ambitious objective was not achieved.

It is of particular interest to note that the general outline of Shackleton's plan for his 'Imperial Trans-Antarctic Expedition' of 1914–17 was identical with that now being organized and planned by Dr. Fuchs, with the backing of this Society. I have just been reading an address which Shackleton gave to this Society on 9 February 1914; in this address he described his plans for the great crossing and outlined the scientific results which he hoped to obtain; I was much struck with his concluding words which were as follows: 'The crossing of the continent lies first and foremost in our hopes, and I feel that, whatever it may be called—sporting feat, or whatever name it may go by amongst the sympathetic or the unsympathetic—this work is the primary work of the Expedition.'

These words apply with equal force to the new Expedition now being organized. The human effort involved in that great journey was, and still is, the main feature of the project. My predecessor, Mr. James Wordie, was Geologist and Chief of the Scientific Staff of Shackleton's Expedition; when *Endurance* was crushed in the ice in lat. 69° S. he, with twenty-seven companions, was marooned on an ice-floe, but they were eventually rescued from South Georgia.

My own connection with Sir Ernest Shackleton is a more personal one; when I was still a junior subaltern, forty-five years ago, Shackleton, who was a friend of my father's, and I were playing golf on the Old Course at St. Andrews during a summer holiday. I mentioned to him a project I had of going to Spitsbergen with a Norwegian friend of mine on a survey expedition. Shackleton at once insisted that I should join the R.G.S., and offered to propose me for Fellowship. Much to my surprise and

delight I was elected within a few months. Shackleton is one of the great names in Polar exploration; a great leader of men. We in the R.G.S. are proud to have the statue by Jagger, which is the national memorial to Shackleton, enshrined on the east wall of this building."

The President, in accepting the volumes, directed that the opening one should be exhibited in the Society's Museum.

GEOGRAPHICAL ESSAY PRIZE

The Council has accepted the recommendation of the examiners that the Geographical Essay Prize be awarded this year to K. L. Wallwork, at present reading geography at Manchester University. Mr. Wallwork's essay is entitled "Subsidence in the mid-Cheshire industrial area." A prize of £10 will be awarded as usual in the coming year for the best geographical essay not exceeding 5000 words in length, including sketch-maps and diagrams, written by a student reading geography at a university in Great Britain or Northern Ireland during the academic year in which the essay is submitted. It has been decided that the closing date for entries shall be 15 *June* 1956, instead of 15 January as hitherto. The Council reserves the right to publish or to retain for the Library any of the essays received.

THE RECORD

CONTRIBUTORS TO THIS ISSUE OF THE *JOURNAL*

Professor Ardito Desio is Director of the Institute of Geology at the University of Milan, and in the past thirty-three years has led fifteen major expeditions, mainly in the pursuit of geological and mineralogical research. *Commander C. J. W. Simpson*, D.S.C., R.N., led the British North Greenland Expedition (1952–4) and was awarded the Founder's Medal for 1955. *F. Kingdon-Ward*, botanist, traveller, and a Gold Medallist in 1930, was in Assam at the time of the great earthquake of 1950. *Miss Helen Wallis* is an Assistant Keeper in the Map Room of the British Museum, and is compiling a catalogue of early globes in British collections under the auspices of the Bibliographical Commission of the International Union for the History of Science. *Wilfred Thesiger*, Society's Gold Medallist in 1948 and a distinguished South Arabian traveller, was recently in Afghanistan where he visited the Hazaras; his paper on the marshmen of Southern Iraq was published in the *Geographical Journal* for September 1954. *W. B. Morgan* has been a Lecturer at University College, Ibadan, since 1953; he published a paper on land use in the Shire Valley of Nyasaland in the *Journal* for December 1953. *H. H. Lamb* is on the staff of the Meteorological Office of the Air Ministry; he accompanied the whale factory ship *Balaena* during the 1947/8 season, and his paper is to some extent a sequel of his "Topography and weather in the Antarctic" in the *Journal* of July 1948. *Commander G. P. Britton*, R.N., was formerly in charge of investigational work at the Royal Naval Weather Centre at Simonstown. *K. R. Sealey* is Lecturer in Geography at the London School of Economics.

THE MOUNT EVEREST FOUNDATION

Grants to scientists whose field of work is, geographically, a mountain region are now available from the funds of the Mount Everest Foundation, which has recently been set up by the Royal Geographical Society and the Alpine Club. These funds represent the proceeds of the books, film, lectures and other activities which followed the successful Everest Expedition of 1953, sponsored by the two constituent societies of the Foundation.

The broad object of the Foundation is the support of expeditions for the exploration of the mountain regions of the earth; namely, of mountaineering expeditions exploring, to some extent at least, little-known or unknown territory, but not necessarily engaged in a particular branch of scientific research. But provision is also made, more specifically, for the support of scientific investigations in mountain country, not necessarily involving special mountaineering technique, or new exploration in a geographical sense.

In this scientific field, grants may be made in support of research into geography, topography, geology, ethnology, meteorology, botany, zoology, entomology, glaciology, and allied studies, either in, or concerned with, mountain regions. Physiological studies dealing with the effects of altitude upon the human organism, and the means of countering such effects, are also among the objects of support by the Foundation.

Enquiries from those seeking grants should be addressed to the Honorary Secretary, Mount Everest Foundation, c/o Alpine Club, 74, South Audley Street, London, W.1., from whom standard forms of application may be obtained. Completed forms of application should reach the Foundation not later than February 1, April 1 and October 1 each year, for consideration in April, June and December respectively.

UNESCO GRANTS FOR REGIONAL STUDIES

A circular has just been received from the United Nations Educational, Scientific and Cultural Organisation, too late for inclusion in an earlier *Journal*, on the subject of grants for regional cultural studies. Although the closing date for applications in the current year was 15 June 1955, it is thought readers of the *Journal* may be interested in particulars of the scheme.

Paragraphs 5 and 6 of this circular CL/1023 read as follows:

". . . It is proposed to offer financial assistance to cover part of the cost of individuals spending from six to nine months in a university situated in a cultural region different from their own, in order to carry on advanced study and research on some aspects of the country visited. The main purpose of the programme of study will be to enable specialists in such fields as language, literary or cultural history, geography, economics and social problems to use their special knowledge in order to orientate themselves in the broader problems of the culture and social life of the region or country visited.

"The type of person to whom it is envisaged these grants would be made is the post-graduate specialist, university lecturer or junior professor. He might, in addition to pursuing a programme of research, be invited by the host university to conduct language courses, or assist informally in instruction in his own speciality; the purpose is not, however, that the scholars should undertake extensive teaching responsibilities."

It is stated further that grants would cover the cost of long-distance travel to the region chosen, and that all applications should be arranged through the governments who are members of UNESCO. The address in Great Britain for applications would be the United Kingdom National Commission for Unesco, Ministry of Education, Curzon Street House, London, W.1.

UNDERGRADUATE PUBLICATIONS

The Cambridge University Explorers and Travellers Club has issued the first number of its journal *Visa*. This contains short, lively accounts of its activities, which aim at capturing some of the romance of travel, rather than at serving as a vehicle for scientific findings. Copies, price 2*s*., may be obtained from P. Swann, Clare College, Cambridge.

We have also received a copy of *Aspect*, the first student publication of the Oxford University School of Geography. This contains a number of thoughtful articles on topical subjects, designed to reflect "our belief in the special value of Geography in the shrinking world of the politicians and expanding realm of the planners."

Recent numbers of other undergraduate magazines received include *Horizon*,

February 1955, from King's College and London School of Economics Joint Department of Geography, which contains notes on field excursions in Austria and regional studies in Britain, and *Cosmos*, No. 9, 1954, the magazine of the Geographical and Geological Societies of Queen Mary College, University of London, a well-produced number with a varied contents.

SOVIET GEOGRAPHICAL SERIALS IN THE SOCIETY'S LIBRARY

BULLETIN (IZVESTIA) OF THE ACADEMY OF SCIENCES OF THE U.S.S.R.: GEOGRAPHICAL SERIES FOR 1955. No. 1 (January–February). Second Congress of the Geographical Society of the U.S.S.R. and the tasks before Soviet geography. The temperature of glaciers, by G. A. Avsiuk. Historical changes in the animal life of our country between the 13th and 19th centuries, by S. V. Kirikov. Micro-climatic conditions of tea-growing regions in the northern sub-mountainous areas of the Krasnoyarsk district, in winter, by A. F. Zinina. Measurement of the supply and current of rivers in the Mongolian Peoples Republic, by N. T. Kuznetsov. Centenary of the birth of A. P. Petrov, by V. A. Varsanofieva. Methods of geomorphological research, by N. V. Bashenina. Terminology in the study of frozen soils, and its relation to other sciences by L. A. Meister. Anti-glacialism, by K. K. Markov. The tenth meeting of the International Geophysical and Geodetic Congress.

No. 2 (March–April). Second Congress of the Geographical Society of the U.S.S.R. Climatic factors in the watering of continents by M. I. Budyko. Geo-botanical research in French Guiana, by E. M. Davrenko. Meteorological characteristics of the year 1954 in the Altai and North Kazakhstan, by B. L. Dzerdzeevskii. Climatic conditions in the recently agriculturalised areas of North Kazakhstan and the Altai, by Y. I. Feldman. Some characteristics of lakes in areas of North Kazakhstan, by N. T. Khznetsov. Natural regions of the recently agriculturalised areas of Altai, by G. V. Zanin and others. Geography in Kirgizia, by E. M. Murzaev.

BULLETIN (IZVESTIA) OF THE ALL-UNION GEOGRAPHICAL SOCIETY, LENINGRAD. Vol. 87 (1954). No. 1 (January–February). On the theory and practice of "complex" geographical investigation in agriculture, by N. V. Krylov. Development of the "kolhoz" in the Far Northern territories of the U.S.S.R., by N. M. Kovyazin. Muddy zones in the rivers of Siberia and the Far East, by G. V. Lopatin. Ascent of Everest 1953, by S. V. Obruchev. The historical geography of the Tian-Shan and the Pamir-Alai, by A. N. Bernshtam. A. N. Beketov as a geo-botanist, by A. A. Korchagin. Formation and origin of the coastal sand dunes of the Baltic, by A. I. Kravchenko.

No. 2 (March–April). Report and resolutions of the Second Congress of the Geographical Society of the U.S.S.R. Socialist changes in the agriculture and way of life of the Evenks of the Ilimpiiskii region (Krasnoyarsk district), by M. A. Kaplan. The formation and development of timber blockages in rivers, by Y. F. Chemekov. Investigation of landscape in the field, by O. N. Kazakova. Some problems of landscape study, by I. M. Zabelin.

CONGRESS OF ONOMASTIC SCIENCES

The Fifth International Congress of Onomastic Sciences (Toponymy and Anthroponymy) was held at the University of Salamanca from the 12th to the 15th April 1955, under the patronage of the Head of the Spanish State, General Francisco Franco. Such Congresses are organized triennially by the International Committee of Onomastic Sciences, which is affiliated to UNESCO. More than two hundred delegates attended, mainly from Western European countries, but there were representatives also from Brazil, Canada, India, the Philippines, Turkey and the United States. H.M. Government, the Permanent Committee on Geographical Names and the Society were represented at the Fifth Congress by Mr. P. J. M. Geelan, the newly appointed Secretary of the P.C.G.N.

Of the six sections into which the Congress divided for working purposes one was devoted to general, and three to European, onomastics, with the rest of the world being

subordinated to a single, fifth, section. There were about eighty papers presented, rather too many for the limited time available, resulting in hurried reading and inadequate discussion. A congress of this sort suffers perhaps from the lack of a unifying theme. The only section of the Congress to have a specific subject for discussion was the sixth, which devoted itself to a consideration of the problems of the international standardization of geographical names. This arose from a resolution proposed by the official United States delegation to the Third Congress (Brussels, 1949). Particular attention was given to Africa, where the multiplicity of languages, conflicting orthographies, and different colonial and administrative interests have led to the present confused state of African place-names. The deliberations of the sixth section produced a resolution, approved by the final plenary session of the Congress, that there be established a Commission on International Standardization of Geographic Names to review the general problem and to make recommendations to the Sixth Congress in 1958, and that sub-Commissions, in particular for North Africa and for Africa south of the Sahara, should be appointed to study particular areas.

The city of Salamanca provided a delightful setting for the Congress, and the University and its staff, in particular the Rector, Dr. Antonio Tovar, and the Secretary, Dr. Garcia Blanco, were perfect hosts. Among the entertainments provided for delegates were an exhibition of Salamancan folk-dancing; a guitar recital of exhilarating versatility; and a visit to a bull-breeding farm, where the cry of "on demande des congressistes dans l'arène" was stoutly answered by a number of toponymists who made *veronicas* with fumbling bravado at a very small and very tired young bull.

The end of the Congress was marked by a serious, though none the less colourful, ceremony in the Hall of the University, at which several of the more venerable delegates were decorated with the Order of Alfonso the Wise, and Professor H. J. van de Wijer, Secretary-General of the International Committee on Onomastic Sciences, received an honorary doctorate. P. J. M. G.

WATER MINING IN EIGHTEENTH CENTURY ENGLAND

The eighteenth century was a great age of exploration, not only overseas in the Pacific and South Atlantic, but underground in search of minerals and, as related below, of water. The scientists of the day, and particularly the Cambridge men, were alive to the economic possibilities of the new knowledge. The Rev. Stephen Hales here referred to was a foundation member and Vice-President of the Society of Arts established in 1754. It should be borne in mind, when reading this note, that the landlords of the day were resident landlords, improving their estates and, in this case, sharing in the risks of improvement.

The manuscript which prompts these observations is to be found in the Berkshire County Archives at Reading, in the form of a memorandum prepared by Sir Mark Pleydell, owner of Coleshill Estate, Berks, for the Reverend Stephen Hales, the Cambridge physiologist and F.R.S. The memorandum is headed "A Journal of water sinking at Coleshill, 1743–5" and is drawn up as a report beginning "Dear Sir." It appears that local inhabitants had reported that the ground which Sir Mark Pleydell proposed to penetrate in his search for water was bottomless rock, but with a team of four the enquiring landlord went to work. Sometimes the sand fell on them and buried them. On one layer of rock "we did not advance a yard in a fortnight. In this emergency we had recourse to Chambers Dictionary and Gunpowder, in which after many dangerous experiments we at last perfectly succeeded." Despite pumping "our whole mine was converted to a liquid mud in which the miners stood knee deep." "Being advanced to 48 yards the damp appeared and became our constant companion." The miners knew it was coming by an inclination to cough. Soon after the candle was extinguished. Faintness and shortage of breath followed. "Our men could only keep 3 out of 12 candles in at a time." After abating, the damp returned with redoubled fury, and threatening immediate death, drove them before it. They found deep lime roots under the ground, with fibres reaching down to 100 feet. The miners

worked in their shirts, "and my own stuck to my skin." When they were down below, the mine caved in with the noise of thunder, and all retreat was cut off. But the carpenter squirmed through and released the owner and his men before a second fall during the night. It took five days to clear the arch. "We made a communication by boring between our mine and a well, and the same instant the damp ascended in a visible body of smoke. The air became sweet, the candles burnt, and the arch itself terminated in the well. After making a channel, which in some parts was 2 feet below the side walls, we measured our current at 42 Hhds [hogsheads] in 24 hours. The miners were trapped a second time by a wall break. One man they dug out, his mouth full of dirt, and hauled him up by ropes, carrying him off half-dead in a hackney chair. His mate also was rescued because the jammed stone became a sort of helmet to his head, though there was heavy pressure on his breast and belly. But despite all setbacks, they went at it again.

The owner, going down once more, observed a river of mud, enough to drive a mill, descending from the top of the rocks. "Our wishes were now crowned with the highest success. Our only care was how to dispose of so great a quantity of water and to guard against inundations. But 24 hours delivered us from this perplexity and discovered to use the true state of our new rivers;" and they made a large reservoir to store the water.

This closes the Report, which is followed by "Facts and Observations of which Mr. Hales perhaps may make some use."

"1. In my enquiries I resolved to trust to no man's eyes but my own. I frequently descended.

2. To conduct a spring there must be an Arch (till it comes into the open air) a Channel, and Cement. Nature has supplied these three, for the top rock is the Arch, the bottom rock the Channel and the adjoining earth the Cement.

3. The current of a spring may be lost and hard to find, but the spring itself can't vanish. It is as easily stopped with dirt, as a bottle with a cork, and as easily opened if you can but hit upon the right place."

The memorandum is followed by comment from Stephen Hales:

"1. In explosions the less the report the greater the explosion. 2. Sand filters the water. 3. It is common to find wells (especially in Farringdon parish) at different depths owing to different strata."

There is a further letter from Hales to Sir Mark Pleydell concerning noxious air: Admiral Boscawen's purser, writing from Cape of Good Hope, tells him that "out of 715 men on board they had not then one sick man and that but two had died since they left Portsmouth Oct. 11. This great degree of healthiness they attribute to my ventilator, which they fixed on board at the beginning of the voyage."

"I should have sent this under cover to Mr. Bouverie, if I had been sure of his being with you. I beg my compliments to him. I spent two days with Ld. Folkestone in July at Sonning Hill."

It may be observed in conclusion that Sir Mark's daughter married William Bouverie, Viscount Folkestone, who thereby took the name of Pleydell Bouverie, created Earl of Radnor 1765. There were Pleydell Bouveries at Coleshill up to very recently.

C. R. F.

GEOLOGICAL SURVEY AND RESEARCH IN THE SOVIET UNION

A summary of a paper presented by the Delegation of the U.S.S.R. to the Working Party of Senior Geologists for the preparation of a Regional Geological Map for Asia and the Far East. (Bangkok, November 1954.)

From 1918 to 1938, 50 per cent. of the U.S.S.R. was geologically surveyed, including 10 per cent. on detailed scales. This work formed the basis for the publication of the 1/5 Million geological map of the U.S.S.R. in 1937.

The second stage in the development of geological survey was the mapping of almost the entire country on a scale of 1/1 Million. Of the total of 179 sheets required

to complete this work, 100 have been published and the series will be completed by 1960.

The third stage, now in progress and to be completed within the next few years, is the survey of all the principal mining and agricultural regions on a scale of 1 : 200,000 (1 : 100,000 in complex folded areas). About 35 per cent. of the area of the Soviet Union has been covered on this or larger scales and 50 per cent. of the area is expected to have been surveyed on scales of 1 : 200,000 or 1 : 100,000 by 1960. Six hundred sheets will be published in the near future, covering W. and E. Siberia, the Altai, Central Asia, Urals and Caucasus. Detailed surveys of these areas on scales of 1/50,000 and 1/25,000 are also in progress.

In addition to geological maps, special maps of many different types are being produced in the U.S.S.R. Work is now being carried out, for example, on a hydrogeological map on scales of 1/5 Million and 1/2½ Million. (1/50,000 or 1/25,000 for some of the more important agricultural regions.)

Stratigraphy and lithological research.—A great deal of work has been done in these fields. The results have been published in a series of volumes, such as 'The Stratigraphy of the U.S.S.R.,' 'Palaeontology of the U.S.S.R.' etc. Research methods for fossilized pollen and spores (palinology) and fossilized seeds (carpology) as well as diatomal analysis are in wide use. The study of sedimentary rocks was greatly stimulated by the conference held in 1952, on questions of the theory of sedimentary accumulation.

Tectonic research.—A tectonic map of the U.S.S.R. (1/4 Million) was published in 1953 and in the following year work commenced on a composite tectonic map. There is a special serial publication dealing with tectonic research—'Tectonics in the U.S.S.R.' Research to date has established the basic structural outline of the Soviet Union as follows. Besides the Siberian and Hindustan platforms which form the framework of Asia, another major platform, the Chinese platform, has been singled out in the past years. The Asiatic branch of Thetis stretches between the Chinese and Hindustan platforms, while the Mongol–Okhotsk geosynclinal region is enclosed by the Chinese and Siberian platforms and the east Asiatic geosynclinal region borders these platforms in the east. The Ural geosynclinal region, which includes the Taimir, fringes the Siberian platform in the north and west.

Exploration of the Siberian platform confirms certain peculiarities—numerous deep cracks which cut the platform off from the Paleozoic and Mesozoic folded regions, and break it into parts. These cracks provided passage to the surface from the depths of the earth, for magmatic melt and hydrothermal solutions.

The east Asiatic geosynclinal region has proved to be more complex than was thought before. On its south-western outskirts, within the boundaries of the U.S.S.R., blocks of pre-Cambrian and early Paleozoic structures came to the surface, and in the east they join zones of late Paleozoic and Mesozoic folded structures, and contemporary geosynclinal zones (Yellow, Okhotsk and Behring Seas) with the anticlines they embrace. These anticlines are composed of folded Cenozoic complexes (Sakhalin, Kuril Islands, Kamchatka). Within the east Asiatic geosynclinal region there are median masses (Ussuri, Zeya, Alazeya, Middle Kolyma), whose origin is referred to the middle Paleozoic era. The Mongol–Okhotsk geosynclinal region includes a zone of early folded Paleozoic structures in the north, and zones of late Paleozoic orogenisis further south. East of Lake Baikal, young Mesozoic structures cover these ancient folded complexes. In Kazakhstan and Central Asia, the Ural geosynclinal region adjoins the western part of the Mongol–Okhotsk geosynclinal region, known as the Tien Shan geosyncline. The latter is a complicated, primarily late Paleozoic folded structure, embracing blocks (geoanticlines) of early Paleozoic and pre-Paleozoic folded structures. In the east of Central Asia, this geosynclinal region borders on the geosynclinal region of the eastern branch of Thetis, which includes, from north to south, Paleozoic (Alai and Kuan-lun), Mesozoic (Karakorum), and Cenozoic (Himalaya) folded zones.

In the latter half of the Paleozoic and in the Mesozoic era, uplift movements began in the south and east of the Asiatic continent, towards the conclusion of the geosynclinal process. These movements were part of a specific anticlinal stage of the development of the Earth's crust, distinguished from the geosynclinal stage by a sharp predominance of erosion over accumulation of sediments, the continental character of the latter, the dying out of intrusive activity, a wide development in places of effusive activity, with typical eruptions of basic and medium lava. At about the same time, sinking took place in the west and north, leading to the appearance of marine depressions in the Polar basin, and of the immense synclines of Turgai, the West Siberian lowland, and the Khatang depression.

In spite of the established platform-type constitution of a large part of the continent of Asia, a "rejuvenation" has been observed, as late as in the Alpine period of folding: Tien Shan, Tibet, Djungar Alatau, Altai, West and East Sayansk Mountains, and Khamar-daban. Exploration of geosynclinal and platform regions and a study of the history of their development reveal a connection between sedimentary and magmatic rocks on the one hand, and the development of large tectonic forms on the other. This serves as the basis of contemporary conceptions on geological formations. Hence the tectonic facies, and lithological analysis of geological formations is considered a natural foundation for scientific forecasting of exogenous as well as endogenous occurrences of mineral deposits. Making use of this analysis, Soviet scientists have been able to successfully direct prospecting for oil, coal and metals, leading to the establishment of important new mining districts. G. S. G.

OCEANOGRAPHY IN THE UNITED KINGDOM

The recent Commonwealth Oceanographical Conference marks a stage in the long trail that began with the great circumnavigating *Challenger* expedition of 1872–76. Originated by Professor Wyville Thompson of Edinburgh University, it made the Scottish capital, with the *Challenger* officers under Sir John Murray, the national centre of research in oceanography. Thereafter, the tale is one of neglect, and this country, with more reason for interest in the sea than most, failed to give adequate support from public funds to the new science. Smaller countries, such as those of Scandinavia, mounted first-class expeditions and put us to shame by their generous support of marine science. As equipment and ships increased in complexity and cost, the position progressively worsened, until of recent years it has become impossible for any body less than a national government to find the funds necessary for the maintenance and equipping of ocean-going research vessels.

In 1950, six years after the then Hydrographer to the Navy, Vice-Admiral Sir John Edgell, K.B.E., C.B., F.R.S., had first suggested it, the National Oceanographic Council was incorporated by Royal charter.[1] This body was given the duty of "advancing the science of oceanography in all its aspects" and funds were provided from United Kingdom and Commonwealth treasuries in proportions of roughly 10 : 1. A Council was set up under the chairmanship of the Civil Lord of the Admiralty and composed of representatives of the appropriate government departments, those Commonwealth governments which were prepared to help, the Universities and a selection of interested societies, among them the Royal Geographical and the Royal Scottish Geographical Society. The Royal Research Ships *Discovery II* and *William Scoresby* were made over to the Council and an Institute of Oceanography was created for research work on shore. This was eventually concentrated at Wormley in Surrey in a former Admiralty building which had been converted into a suite of up-to-date marine laboratories with all ancilliary services.

This in no way supersedes the existing United Kingdom marine research stations, of which there are in Scotland the Scottish Home Department's Fisheries Laboratory at Aberdeen, the Scottish Marine Biological Associations Oceanographical Laboratory in Edinburgh and Marine Laboratory at Millport. The latter is closely associated with Glasgow University. At St. Andrews is the Gatty Marine Laboratory and at Inveresk the Institute of Seaweed Research.

In England, Government sponsors the Fisheries Laboratory at Lowestoft and the Experimental stations at Conway and Burnham-on-Crouch. The Marine Biological Association of the United Kingdom runs the Plymouth Marine Laboratory and certain Universities also have marine stations; Wales at Bangor, King's College (Newcastle) at Cullercoats and Liverpool at Port Erin. Most University zoological departments are interested in marine biology and Cambridge and London now have some interest in marine physics. Liverpool University has the unique distinction of a Chair in Oceanography. It cooperates closely with the Liverpool Observatory and Tidal Institute. The Admiralty maintains a Hydrographic Department and did a good deal of oceanographic research in the Admiralty Research Laboratory, and there is a Marine Division at the Meteorological office.

Primarily, the National Institute of Oceanography is concerned with long-term investigations,[2] with assisting in Defence research, and with problems in far-distant waters such as the Antarctic, some of which may be of more direct interest to other parts of the Commonwealth than to the United Kingdom.

Physical Oceanography.—The fundamental problem in the oceans is that of their circulation, and to understand this the interchange of energy between atmosphere and oceans must be examined. American workers have estimated the transport of heat both horizontally and vertically in the North Atlantic and North Pacific and the Institute has extended these observations into the Southern hemisphere. It has also cooperated with the Imperial College of Science in experiments [3] involving observations on slowly-rising balloons, in the Scilly Isles for the Westerlies and the West Indies for the Trades. These have given results rather different from those based on measurements of the slope of water surfaces.

Some of the energy transferred from wind to sea takes the form of waves and drift currents. Wave studies are of course of the greatest importance in relation to coast erosion, harbour works and stresses in ships' hulls. Various ingenious devices are now employed in measuring waves.[4] Near the shore, varying pressures on a limp rubber bag anchored on the sea bottom are conducted by a strong-walled rubber tube to recording apparatus on shore. In place of the rubber bag there is sometimes substituted what is in effect a very low frequency quartz hydrophone. An alternative method is to place an echo-sounder on the bottom and operate it in an upward direction, so obtaining a trace of the varying form of the surface. Another striking method also using a form of echo-sounding is to fly an aircraft fitted with a narrow-beam rapid-response radar altimeter at about 150 feet above the sea. Since the speed of the aircraft is much greater than that of the waves, an approximation to an instantaneous cross-section of the waves is obtained.

For certain purposes a very simple apparatus is formed by an insulated wire with its lower end sealed off and suspended vertically in the sea. This forms a condenser with the water as one electrode. As the waves cause the water to rise and fall, so the capacity of the system varies and gives an index of water level.

For deep-sea work the problem is more difficult. One method is to float a long pole with a large drogue at a depth of about 150 feet so that it passes below (or mainly so) the horizon at which wave action is felt. The pole is thus virtually fixed in the vertical sense and the rise and fall of waves on its upper part can be measured. More effective still is a device which by means of a measuring head on the ship's hull and electronic apparatus inside gives an immediate record of the height of the waves. One of these instruments is now fitted on the Ocean Weather Ship *Weather Explorer* in the North Atlantic. Maximum wave heights of between 40 and 50 feet were recorded at the stormiest season.[5]

Systematic long-term observations at Perranporth in Cornwall have been directed towards analysing the "wave spectrum", and swells so long that they must have originated in the Cape Horn region have been detected there. Very low-frequency waves precede by up to twelve hours the disturbances which cause them and may thus be of use in weather forecasting.

Waves, and particularly standing waves and other interference effects, seem to exert sufficient force on the sea bottom to deform the earth's crust locally, and investigations [6] have been conducted from the records of Kew seismographs into the correlations between weather, waves and microseisms.

Currents have been measured in various ways.[7] One of the most spectacular is that by which the flow of water through the Straits of Dover is continuously observed. A spare submarine cable lent by the Post Office is used for an electromagnetic determination, first suggested by Faraday, of the mass of water pouring through the Straits by measuring the varying voltage between the two sides of the Channel induced by the varying flow of water through the earth's magnetic field.

United States scientists have been liberating buoys which radio back data about wind strength and drift and in England an automatic current float has been devised [8] which, after drifting for a predetermined time almost awash so as to avoid wind influence, anchors itself, rises in the water and hoists a flag to proclaim its presence. The old-fashioned glass drift-bottle has been superseded by plastic-covered floating post-cards [9] which have been dropped by Coastal Command aircraft at the rate of one per mile over the Western Approaches. Their recovery earns the finder 2*s*. 6*d*. and it is hoped that the results may contribute to our knowledge of surface drift with particular reference in this area to pollution by waste fuel oil. The weather ships in the North Atlantic also cooperate by releasing one card per day.

For currents at great depths, experiments have been made with slow-sinking devices which reveal their position by emitting a supersonic signal at short intervals. Further experiments are to be made with equipment designed to float on a certain density horizon and drift there, giving out a strong acoustic signal which is picked up by the ships' echo-sounder and so used to record the submarine current. The drifting equipment is to have a homely housing in aluminium scaffolding poles which have been found capable of withstanding pressures down to 2500 fathoms.

For shallower water, and to give an indication of current strength and direction sufficient for fishermen's purposes, a remarkably simple and effective apparatus has been designed. It consists of what is virtually a submarine wind-sock fitted with a plumb-bob and compass. By the time the sock has taken up position in response to the current, a soluble tablet (as it might be, an aspirin) dissolves and releases a spring which locks both plumb-bob and compass, so recording the necessary data. Any number of these instruments may be attached to the same line, so exploring the situation at several depths simultaneously.

Sub-surface currents are also to be investigated by towing two special current meters at different depths on a long wire, to gauge the difference in water velocity at their respective levels.

Currents are still being computed from temperature and salinity observations in spite of the error introduced by the fact that these are never simultaneous for a large area. An apparatus [10] based essentially on the principle of the Cartesian Diver has been experimented with and appears likely to offer advantages of speed, accuracy and cost over the existing chemical titration method of determining salinity.

Tidal and associated phenomena are receiving close attention and in particular the oscillatory phenomena which may produce surges ranging in scale from those which contributed to the catastrophes on the East Coast a few years ago, to smaller "ranges" which may yet have a serious nuisance value in snapping mooring ropes of ships in harbour. Rip tides as a risk on bathing beaches have been shown to be localized and often indicated by the form of the beach.[11]

Life in the Sea.—Claims both of the biological sciences and of food supplies [12] continue to direct attention to life in the oceans. By far the greatest proportion of marine life is minute in size and floats helplessly with the drift. Some day mankind may be able to use it directly for food but at present no economical method has been found of handling the vast volumes of water that would be involved in concentrating it. Attention therefore remains on the fish and whales and research proceeds not only

towards the conservation of existing fishing grounds but the discovery of new ones. In order to understand these larger organisms, however, it is necessary to study not only their life history but that of their food. A detailed study of the micro-organisms is thus a fundamental preliminary to understanding life in the sea. Since the micro-organisms are at the mercy of the currents and vertical water-movements both for food and transport, the link with physical oceanography is strong.[13] For example, a higher density of fish population on a certain part of the southern North Sea has been shown [14] to be related to a concentration there of water emanating from the Thames estuary which, on account of effluent from the land, is rich in phosphorus.

This biological work has ranged from the fundamentals of photo-synthesis, using new radio-carbon techniques, to studies of certain small organisms which are vital as food for larger forms of life; for example, the krill of Antarctic waters which furnish the food of the whales which in turn are of such importance to man. Clearly, if stocks of whales are to be maintained, much must be known about their movements [15] and life history. To this end whales are marked [16] by small darts shot into them from research vessels and it is interesting to note that the cooperation of British, Norwegian, Dutch and South African firms was obtained in 1953 to finance a Norwegian whale-catcher *Enern* for a month's whale-marking.[17] It is an index of the times we live in that the darts were anointed with penicillin.[18]

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R. M.

CORRECTION

"Pediment land forms in Little Namaqualand," by J. A. Mabbutt, *Geogr. J.* **121** (1955) 78–83: Page 82, lines 8/9 from bottom of page should read: "This is well shown by comparison of Plates 2 and 5" and not "Plates 4 and 5."

NOTES

The Committee of the GINO WATKINS MEMORIAL FUND has made the Watkins Award of £50, for 1955, to M. B. Bayly of King's College, Cambridge, in recognition of his geological work in Spitsbergen during the last five years. The Memorial Fund is a Trust resulting from an appeal to the public to raise a memorial to H. G. Watkins, who lost his life in Greenland in 1932; it is administered through the Scott Polar Research Institute, Lensfield Road, Cambridge, from whom particulars may be obtained. The award is made annually for work on polar subjects, and the Committee emphasize that their aim is to help and encourage, at the outset of their careers, those who plan polar work from the United Kingdom. The joint Trustees of the Fund are the Royal Geographical Society and Martin's Bank.

* * *

During June 1955, a "Surveyors and Map Makers Exhibition" was arranged in the Leeds City Art Gallery by the Yorkshire Branch of the ROYAL INSTITUTE OF CHARTERED SURVEYORS and LEEDS CITY LIBRARIES. The exhibits, covering all aspects of survey from the Manuscript "terrier" to the revision methods of the Ordnance Survey, naturally concentrated on maps of Yorkshire and plans of Leeds. An interesting catalogue is available, price 1*s* 6*d*.

* * *

A catalogue of enclosure maps in the BERKSHIRE RECORD OFFICE has been edited by Mr. Peter Walne, County Archivist, and copies may be obtained, price 2*s* 6*d* each, from the Shire Hall, Reading. This is one of the richest county collections of these manuscript maps, prepared in the era of "Parliamentary enclosure," in the first half of the nineteenth century. The entries are arranged alphabetically by parishes. A brief introduction indicates other enclosure material available in the Berkshire Record Office.

* * *

Dr. Calvin J. Heusser, project officer of the JUNEAU ICE FIELD RESEARCH PROJECT of the AMERICAN GEOGRAPHICAL SOCIETY, has been in camp on Lemon Creek Glacier in south-eastern Alaska for two months, supervising the work of the 1955 J.I.R.P. expedition. Detailed studies are being made of Lemon Creek and spot observations of nearby glaciers, in an effort to add to the knowledge of the relationship between glacial behaviour and weather. Dr. Heusser, who is a geo-botanist, was studying vegetation to determine the age of the moraines. The Juneau Ice Field Research Project is conducted by the American Geographical Society under contract with the Office of Naval Research, with the support of the U.S. Army and Air Force, and is the eighth expedition since 1949. Studies made during the first five summers of the project and during the winter of 1951 were devoted to the Taku Glacier, one of the few glaciers in the world that are advancing; last summer operations were transferred to Lemon Creek, a glacier about 4 miles long and 1 mile wide which is receding.

* * *

The Land Surveyors' Committee of the ROYAL INSTITUTE OF CHARTERED SURVEYORS has elected Brigadier Guy Bomford as Chairman for the session 1955–6; Brigadier A. H. Dowson, Vice-Chairman; and Mr. A. Stephenson, Honorary Secretary.

* * *

CORRESPONDENCE

The Harbour Entrances of Poole, Christchurch and Pagham

Mr. A. H. W. Robinson in his instructive and carefully argued paper "The Harbour Entrances of Poole, Christchurch and Pagham" deals with one special case, and probably not a typical case, of a general problem. Mr. Robinson has proved his thesis that the two spits, approaching each other from either side of the Pagham Harbour entrance, formed from the break-up of a single embankment which once crossed the harbour embayment. He also makes a strong case for this sequence of events occurring at the other two harbours, although his conclusion is slightly marred by the misleading and inadequate statement that "the completing (of the embankment) is largely accomplished by storm waves approaching directly on shore *carrying materials scoured from the adjacent sea bed* (my italics)."

An example on a larger scale of the closing of a harbour entrance is that of Romney Hoy on the eastern shore of Dungeness. Orientation and general exposure is much the same as in the examples dealt with by Mr. Robinson and the sequence of events is probably the best recorded of any comparable changes in the British coastline; but the spits of Great Stone and Little Stone did not join in the manner envisaged by Mr. Robinson. They grew towards each other as a result of what must have been two opposing directions of drift converging on the harbour entrance, the one from the south and the other from the north. Similar examples of spits which have narrowed little embayments by growing towards each other can be seen in Carmarthen Bay, where Laugharne and Towyn Burrows have grown eastwards and north-westwards respectively to restrict the Towy Estuary. Also, in Cardigan Bay the dune-capped shores confronting Morfa Bychan and Morfa Harlech have extended south-eastwards and north-north-westwards respectively to constrict the entrance to the Glaslyn Estuary. In such cases the seaward gradient of the fore-shore is very gentle so that the waves responsible for the long-shore drift approach almost head-on to the general line of the shore; but in each case the parts of the spits immediately adjacent to the harbour mouths turn slightly inland. This leads to a small obliquity of approach of the waves as they begin to run up the Estuary, and thus long-shore drift tends, on the average, to approach the slightly curved ends of the two spits from opposing directions. I suspect that much the same has happened at the mouths of Chichester, Longstone and Portsmouth Harbours.

The careful mapping of Scolt Head Island by Professor Steers (see the "Coastline of England and Wales," maps opposite page 358) shows that between 1907 and 1933, as the Far Point of Scolt grew westwards, the spits confronting the Brancaster Golf Course on the opposite side of the harbour entrance grew eastwards. In this example it would seem that the drift causing the additions to the east ends of the Brancaster Golf Course split complex was mainly due to the shelter from north-east winds given by Far Point. This left the eastward drift caused by waves from the west more or less unchecked.

So, whilst agreeing with Mr. Robinson's conclusions for the examples he cites, perhaps I may be forgiven for pointing out that the instances he has chosen are not typical of conditions at larger harbour entrances.

W. V. Lewis

Department of Geography,
Cambridge,
30 *May* 1955

In his article on these entrances (*Geogr. J.* **121**, March 1955), Mr. A. H. W. Robinson brings out the basic similarities of their physical evolutions. There is,

however, a factor in the evolution of the Christchurch entrance which has not been present at either Poole or Pagham.

The supply of beach-forming material at Christchurch has fluctuated greatly from the beginning of the nineteenth century to the present day, and this has affected the remarkable changes in the length of the spit. This fluctuation can be traced principally to human activity at Hengistbury Head. At the beginning of the nineteenth century, the rate of recession of the Head was, from the physical point of view, constant and natural. It was certainly rapid, but not rapid enough to provide a great surplus of beach-forming material at the entrance to the harbour. As far as is known, these conditions persisted for a long period; while the position and depth of the entrance altered from time to time, the periodic formation of an abnormally long spit does not seem to have occurred. Material which was eroded from Hengistbury Head was absorbed into the normal pattern of longshore movement.

About 1820, however, the doggers in the Bracklesham Beds at the Head began to be valued for their iron content, and their removal commenced. This was at first spasmodic, and only the loose doggers on the shore were taken. After 1848, however, the Hengistbury Mining Company began a systematic quarrying of the Head, on both the landward and seaward sides. Doggers were also removed from between the tide-marks and from the inshore part of Christchurch Ledge. The cliff face was loosened and large quantities of fine material were brought down. Also, the beach which had been held up by Christchurch Ledge disappeared to leeward. The supply of beach-forming material was therefore increased to a point where it could no longer be dealt with by the natural processes of longshore drift.

After much public pressure, the Company ceased operations in 1870. Mr. Robinson points out that in 1880 the spit had grown to its greatest recorded length, and later maps show that each subsequent extension has been progressively shorter. Perhaps these subsequent growths were still the outcome of the original quarrying, coupled in more recent years with attempts to stabilize the coast with engineering works. Since the completion in 1938 of the long groyne at Hengistbury Head, the spit has shown no signs of resuming its periodic growth, and there seems to be little chance of it doing so in the future.

A. SHEPHERD

Department of Geography,
Makerere College,
Kampala, Uganda,
31 *May* 1955

PEDIMENT LAND FORMS IN LITTLE NAMAQUALAND, SOUTH AFRICA

Mr. J. A. Mabbutt presents us with some very welcome evidence in his courageous attempt to resolve one of the most difficult problems of geomorphology (*Geogr. J.* **121** (1955) 77–83); but his writing and reasoning are difficult to follow in places, and I should welcome some further clarification of a few points. The mountain faces rising out of the pediments slope at 30°–35°. This slope is, according to Mr. Mabbutt, determined by "the minimum angle for mass movement of the slope boulders" (p. 78), and yet in the next sentence he states that "in the process of mountain-front retreat mass movement is far subordinate to water action." Again, at the foot of the page, is the statement "the running water grading the pediment would seem to be responsible for the retreat of the mountain base." Mr. Mabbutt is not primarily concerned with these mountain or hill slopes in his paper, but he says enough to show that he has observed and considered them carefully and I should like to know whether he considers that mass movement or flowing water really formed these slopes. His references to "hill wash acting at boulder controlled angles" (p. 80) seems to me to indicate further confusion between these two different processes.

Secondly, Mr. Mabbutt attributes the absence of stream channelling in the

pediment to "heavy load conditions." This is, I suspect, only a subsidiary cause. Is not the real reason the inability of the streams to lower their beds because of the base level effect of the surrounding plains into which the pediments merge and to which they are graded? We can produce miniature pediments remarkably true to life in the Physiographical Laboratory at Cambridge by sprinkling fine "rain" on to a slope formed of five parts sand to one part mud from the River Cam. Unfortunately, these models were not working when Mr. Mabbutt was with us. In these models a lack of channelling is simply due to the lack of ability to cut downwards, but I should welcome Mr. Mabbutt's comments on this point. W. V. LEWIS

Department of Geography,
Cambridge,
30 *May* 1955

A LIFE OF SIR ERNEST SHACKLETON

We are writing a biography of Sir Ernest Henry Shackleton (1874–1922). The Antarctic explorer's family has kindly given us access to all relevant papers in their possession, many of them unpublished.

We are most anxious to get in touch with all who knew Shackleton, particularly those who shared his business enterprises as well as those who explored with him. Any documents or correspondence in the possession of his friends and colleagues would be welcomed, respected, promptly transcribed and returned.

Old Rectory, MARGERY FISHER
Ashton, Northampton, JAMES FISHER
27 *June* 1955

MEETINGS: SESSION 1954–55

Meeting of 25 April 1955. Mr. Brooks in the Chair

Film: Moana: A Robert Flaherty documentary film of Samoan life

Meeting of 2 May 1955. The President in the Chair

Elections to Fellowship: Syed Zahiruddin Ahmed; Edward Miles Birkett, B.SC., A.M.INST.C.E.; The Marchioness Curzon of Kedleston, G.B.E.; Dr. Peter Davis; Kenneth Holford Gray; John Alan Healey; Harry Hilton; Major A. F. Joslin, B.A.; Charles O. Mashburn, TH.D.; Madhukant J. Mehta; Inst. Lieutenant Harry G. Middleton; Rear Admiral Cecil R. L. Parry, C.B., D.S.O.; Sanan Phewnual; Peter F. Pollard, B.A.; Major Daphne L. M. Portway; Frederick C. Restall, B.SC.; General Sir Ouvry Roberts, G.C.B., K.B.E., D.S.O., M.A.; 2nd Lieutenant Adrian N. M. Sanders; Mrs. Agnes Ogilvie-Thomson; Peter John Wakeman; Rev. Harold Wittig; John H. Worthington

Elections to Associate Membership: Anthony Barry Thomas; Miss Margaret Williamson

Paper: The Falkland Islands and their Dependencies. By Sir Miles Clifford

Meeting of 9 May 1955. Professor S. W. Wooldridge in the Chair

Paper: The nature and significance of tors. By Professor D. L. Linton

Meeting of 23 May 1955. The President in the Chair

Film: From blossom time to autumn frost. Hungarian nature film with commentary by Dr. E. Hindle

Meeting of 6 June 1955. The President in the Chair

Elections to Fellowship: Keith Charles Arnold; Mrs. Mary Elizabeth Arthur; George Patrick J. Barry; Lawrence L. G. Bray; James Cecil Buckman, B.SC.; Reverend Cecil Stanley Bull; Michael Bullock; Philip B. G. Charles; Peter Murphy Cole; Leonard John Collier, B.SC.; Herbert Baynes Craft; Miss Ina Patricia Crohn, B.SC.; Robert R. M. Davy; Godfrey R. V. Dowling; Alfred Ernest Drew, B.A.; Miss Mary E. Duce; Thomas J. I. Edwards, B.SC.; Francis E. Elliott, PH.D., M.A.; Peter Edward Fairbairn; John Philip Gaukroger; David John Greathead; Richard David Greenfield; Hugh Thomas Hale, B.SC.; Roland Allan Harry, B.SC.; Instr. Commander John S. Hewitt; Peter Hopkirk; Captain Alfred Instone; Frederick John Janes; David Lawrence Johnson, B.SC.; Gordon Louis Johnson; Reverend Eric Kay; John Henry Maples; Sydney Edgar Matthews; Ronald Frederick Mayes, B.A.; Edward Frederick Mills; Mrs. Barbara Mons; Raymond L. Newbury; William McLaren Paterson; James Douglas Pearson; Patrick Elliott Rickeard; Brian Walter Scott, M.B., CH.B.; Paul William Sefton-Brown; Harold B. Shaw; Mrs. Helen Mary Starling; Ralph H. Tigg; Cyril J. F. Townson; Reverend William J. E. Tregenna-Piggott; R. A. Walford; Reverend John James S. Whyte

Elections to Associate Membership: Malcolm Slade Higgs; Anthony John James; Edward Stuart Sheldrake

Paper: Ellesmere Land. By G. Hattersley Smith

Meeting of 13 June 1955. The President in the Chair

Film: Royal roads of the Incas. Colour film with commentary by Victor von Hagen

ANNUAL GENERAL MEETING, 20 June 1955. The PRESIDENT, General Sir JAMES MARSHALL-CORNWALL, in the Chair

The PRESIDENT, in opening the proceedings, said: It is my first duty this afternoon, and a very pleasant one, to offer, on behalf of the Council and Fellows of this Society, a very warm word of welcome to our Honorary President, Her Royal Highness the Duchess of Kent. We are well aware of the great number of social duties incumbent on all members of the Royal Family, particularly at this season of the year. We therefore appreciate all the more deeply Your Royal Highness' effort in keeping this date with us. We greatly appreciate visits from our Honorary President, who takes considerable interest in the activities of the Society.

The HON. SECRETARY, Dr. Edward Hindle, then read the Minutes of the Annual General Meeting held on 21 June 1954, and these were confirmed and signed by the President.

The PRESIDENT then delivered his Presidential Address which is printed at pages 257–260.

The PRESIDENT: And now I invite our Honorary President to present the Medals and Awards which the Society grants annually.

Her Majesty The Queen has approved the award of the *Patron's Medal* to Dr. John Kirtland Wright, lately Director of the American Geographical Society of New York. Dr. Wright, in his long service on the staff of the American Geographical Society, culminating in the Directorship from 1938–49, has not only done a great deal to advance geography in the United States, but by his encouragement of international cooperation, he has rendered considerable service to our subject throughout the world. He was associated with the early days of the Million Map of Hispanic America, initiated by his predecessor, the late Dr. Isaiah Bowman (also one of the Society's Gold Medallists), and has continued to foster that project zealously. In addition to his work for modern cartography, Dr. Wright has made a reputation as an expert in the history of cartography and geography. This medal is also conferred as a mark of our appreciation of his constant readiness to extend the good relations which have existed between our two Societies over the past century.

Dr. JOHN K. WRIGHT: Your Royal Highness, Mr. President, My Lords, Ladies and Gentlemen,—To me this is a moving experience; it is also a rather surprising experience. For 125 years the Royal Geographical Society has been the world's greatest institutional protagonist of exploration, whereas what little exploration I have carried out has been in the realm of books and ideas. However, for about twelve years I held a position in the American Geographical Society comparable to that of Mr. Kirwan in your Society. Therefore, I think Mr. Kirwan will understand what I mean when I say that, though I cannot claim to be an intrepid explorer, I can at least claim to be considered what my ingenious British colleague, Mr. O. M. Miller, has called an "extrepid implorer." This wonderful medal and all that it implies is naturally enormously welcome to me personally, but even more so as a tribute to the Society with which I have been connected for thirty-five years and with which I have been very happy. Thank you very much.

The PRESIDENT: The *Founder's Medal* has, with Her Majesty's approval, been awarded to Commander C. J. W. Simpson, D.S.C., R.N., for his leadership of the British Expedition to North Greenland, 1952–4. Those who were present at Commander Simpson's lecture at the Royal Festival Hall last November will have a vivid recollection of the conditions which this Expedition had to face, and the extent of the explorations achieved by this, the largest polar expedition to have left this country for many years. A special feature was the cooperation between the Services, the Merchant Navy and scientists. In bringing their activities to a successful conclusion, Commander Simpson showed that determined leadership characteristic of the Royal Navy, whose officers and men have done so much to further our knowledge of the Polar regions, especially in the early days of our Society.

Commander C. J. W. SIMPSON: Your Royal Highness, Mr. President, My Lords, Ladies and Gentlemen,—In thanking you for the great honour which you have done me today, I know well that it is an honour conferred not only on myself but also on all the thirty members of our expedition; and I appreciate and value the award particularly for that reason. To me personally it has been a great pleasure that the Royal Navy and the other two fighting Services were able to play a substantial part and I hope very much that this interest may continue.

Polar exploration has always been, and still is, intensely the work of a team. And this team-work is important not only in the serious pursuit of science, but also in more domestic ways—cooking, for instance. Anyone who thinks that a couple of dozen young men can be shut up together for the winter and left to cook for themselves without team work, had better go on a polar expedition and see what happens!

The leader of an expedition may plan as he will, but without the solid support of his whole team his plans will be fruitless. Our party in Greenland consisted of some six teams in the field doing different but inter-related jobs. They were all united by our common aims in the bigger team which was the expedition itself. And behind them, again, stood the Expedition Committee and all those public-spirited people without whose generous support the venture would not have been possible.

The PRESIDENT: The Council has awarded the *Victoria Medal* to Sir John Russell, F.R.S., for his studies of soils and agriculture, and for services to geographical education. Sir John is very well known to Fellows as a member of Council and Vice-President for four years of this Society, and as a past President and keen supporter of the Geographical Association. As Director of the Rothamsted Experimental Station and of the Imperial Bureau of Soil Sciences for many years, he has earned an international reputation. He has never neglected the geographical aspects of the problems which he has had to solve, and it is for this, and his encouragement of geography in education, that this medal has been bestowed.

Sir JOHN RUSSELL: Your Royal Highness, Mr. President, My Lords, Ladies and Gentlemen,—I thank you most sincerely, Your Royal Highness, for your kindness in presenting this medal to me. This is a red-letter day in my life. Geographical awards given by the Royal Geographical Society are held in the highest esteem by geographers

all over the world. Ever since I started my connection with agriculture I have felt that agriculture and geography must be closely allied. Indeed, my first paper dwelt on that necessity, and I have always hoped that there would be a close link between the work of the geographers and the agriculturists. It would be easy to give tragic examples of failure to establish that link, but I refrain from doing so now. Your Royal Highness, you have conferred a most memorable honour on me by the presentation of this award.

The PRESIDENT: And now to the Awards. The Council has awarded the *Murchison Grant* to Dr. H. C. K. Henderson. Dr. Henderson, Lecturer in Economic Geography, Birkbeck College, London University, has worked in particular on land utilization in this country, and on the historical geography of agriculture. He has contributed substantially to the memoirs of the Land Use Survey of Britain, directed by Professor Dudley Stamp.

Dr. H. C. K. HENDERSON: Your Royal Highness, Mr. President, My Lords, Ladies and Gentlemen,—To receive an award associated with the name of Sir Roderick Murchison is, indeed, a great honour. I thank the President and the Council for selecting me to receive it. I believe it is somewhat unusual for this award to go to an economic geographer and I am all the more appreciative of it as a result. In my work I have been fortunate in receiving encouragement, help and advice from a number of distinguished colleagues, not least among whom are the recipient of the Victoria Medal, Sir John Russell, and Professor E. G. R. Taylor, whom I am glad to see with us this afternoon.

The PRESIDENT: The *Back Grant* is awarded to Captain O. C. S. Robertson, G.M., R.D., R.C.N. This is an especially appropriate award, for the grant was established by Admiral Sir George Back, R.N., a distinguished Arctic explorer, and it has been bestowed on Captain Robertson for his voyage through the North-west Passage in one season—the first time that has ever been done—in the ice-breaker *Labrador*, 1954. As Captain Robertson is now at sea with the Royal Canadian Navy, I ask Commodore Brock to receive the award on his behalf.

Commodore J. V. BROCK: Your Royal Highness, Mr. President, My Lords, Ladies and Gentlemen,—Captain Robertson has asked me to say how very sorry he is not to be in London today. He is once again at sea in H.M.C.S. *Labrador* on a voyage of survey and exploration of northern waters. Captain Robertson would, if he were here, want to remind us that the success of any seagoing adventure depends to such a very large degree upon the leadership, design, construction, planning and, of course, on the officers and men who, working as a team, make the ship go. He would next, I think, just say "Thank you very much for the honour you have done me," and sit down.

The PRESIDENT: The *Gill Memorial* has been awarded to Dr. Marjorie Sweeting, a graduate of Newnham College, Cambridge, and now University Lecturer in Geography at Oxford. Dr. Sweeting is a physical geographer who has specialized in the physiography of limestone areas and has contributed valuable papers to the *Geographical Journal* on these subjects.

Dr. MARJORIE SWEETING: Your Royal Highness, Mr. President, My Lords, Ladies and Gentlemen,—I accept this award with gratitude. No studies in this country or abroad can be made without the help of innumerable members of small exploration clubs who spend so much of their week-end time trying, like myself, to get down into small holes and clefts in limestone areas. I take this opportunity of thanking friends who have had to bear with me on some of these expeditions. I also count myself lucky in having been able, with the support of colleagues in the Cambridge Department of Geography, to pursue these studies for so long. I should also like to thank the Society because from the beginning of my studies as a physical geographer the Society has helped me in innumerable ways.

The PRESIDENT: Mr. D. G. A. Bunker is awarded the *Cuthbert Peek Grant* for geographical exploration and mapping in South-western Arabia. In the course of work

carried out for the Desert Locust Survey, Mr. Bunker has been able to fill in many blanks in the map, especially in the geographically very important region which forms the transition belt from the peripheral mountain system to the interior sand desert generally known as the Rub' al Khali, the "Empty Quarter." Mr. Bunker carried out mapping to a scale of 1 : 500,000 by car-compass traverse and accumulated much new information on the morphology and geology of the area. In the absence of Mr. Bunker, I ask Mrs. Bunker to receive the award on her son's behalf.

Mrs. E. G. BUNKER: Your Royal Highness, Mr. President, My Lords, Ladies and Gentlemen,—My son is at the moment in East Africa and, unfortunately, not able to be here today. I am very proud to receive this award on his behalf. He asked me to say how much he appreciates the honour done him by the presentation of this award and to convey to you his very sincere thanks for it.

The PRESIDENT: The *Mrs. Patrick Ness Award*, the second to be made from her generous benefaction to the Society, goes again this year to a member of the Norwegian–British–Swedish Antarctic Expedition of 1949–52, to Dr. Roots, who served as Senior Geologist. In the course of the Expedition, Dr. Roots' geological surveys caused him to make some record journeys by sledge and by snow vehicle in a territory where, until this Expedition, no man had yet set foot. Dr. Roots, though he took his Doctorate at Princeton, first graduated in his home University of British Columbia. He is at present taking part in the Canadian Geological Survey's "Operation Franklin" in the Canadian Arctic. I am therefore asking the Deputy High Commissioner for Canada, Mr. Hudd, to accept the medal on his behalf.

Mr. F. HUDD: Your Royal Highness, Mr. President, My Lords, Ladies and Gentlemen,—As you will have gathered, I am an "extrepid implorer," too, because I am shadow-boxing for a scientist. I esteem it a great honour to have had the opportunity of accepting this award on behalf of Dr. Roots who has made such a notable contribution not only to science but to Polar exploration. The honour which the Royal Geographical Society has done him is an honour to Canada as well as to Dr. Roots. The award is well merited and highly appropriate.

The PRESIDENT: Our Honorary President will now address us.

H.R.H. THE DUCHESS OF KENT: Sir James Marshall-Cornwall, Ladies and Gentlemen,—It is a great privilege to be present at this meeting which marks the 125th Anniversary of the Royal Geographical Society. I feel most grateful to you, Sir James, for your welcome to me and for what you said about my connection with the Society, of which I am proud to be the Honorary President. When five years ago I attended, for the first time, the Annual Meeting I remember commenting upon the international character of the Society's work. This seemed to me at the time, as it does now, one of the most important aspects of your activities. I have, therefore, been much interested to look through the records of the Society's achievements since that time. Perhaps the most striking example of international cooperation in the field of exploration has been the Antarctic Expedition of 1949–52, in which representatives from Norway, Sweden and the British Commonwealth took part. The first international expedition to Polar regions, it was, I understand, a highly successful one and of the utmost scientific importance but, furthermore, an admirable experiment in international relations. In this expedition the British contingent included, amongst others, an Australian and a Canadian.

Here I would like, if only for a moment, to refer to the great Commonwealth Trans-Antarctic Expedition which is now in the course of being planned and for which the advance party is due to leave in November. I know you will join with me in wishing them all possible success in the task which lies before them. No reference to the activities of the Society would be complete without mention of the memorable exploits of the Everest Expedition and those other parties which, under the leadership of Mr. Charles Evans, have made the ascent of Kanchenjunga, the third highest mountain in the world.

In choosing and mentioning only a few of the projects upon which the Society has

been engaged during the last five years I have been conscious of other numerous activities in which it has played an important part, and I would not wish to miss the opportunity of offering my congratulations to the Society upon a truly remarkable record of service, not just to the English-speaking people, but to the world at large during that period. In expressing my good wishes, I would like on behalf of the Fellows and Members to congratulate most warmly all those recipients of medals from overseas who are here today, and I extend to everyone connected with the Royal Geographical Society my sincere good wishes for a future as honourable and distinguished as has been its past.

The PRESIDENT then appointed Miss Helen Wallis and Mr. C. R. Niven to act as scrutineers of the ballot for Council and Officers for the ensuing year. While the ballot was taking place the President invited questions or comments on the Annual Report which had been circulated to Fellows.

There being no questions or comments, the HON. TREASURER (Mr. Leonard Brooks) made some general observations on the accounts.

The Annual Report, with the balance sheet, was then unanimously adopted.

The PRESIDENT announced that the scrutineers had reported that the candidates proposed for the Council and Officers for the ensuing year had been elected. The meeting then terminated.

THE 125TH ANNIVERSARY DINNER

THE 125TH ANNIVERSARY DINNER of the Society was held at the Dorchester Hotel, Park Lane, on 20 June 1955. General Sir James Marshall-Cornwall (President of the Society) and Lady Marshall-Cornwall received the company, which included among guests of the Society a number of representatives of learned societies at home and abroad. Among those present were: Admiral Earl Mountbatten of Burma, First Sea Lord, and Lady Mountbatten, the Earl of Munster, Lord Adrian of Cambridge (President of the Royal Society) and Lady Adrian, the Hon. David Bowes-Lyon (President of the Royal Horticultural Society) and the Hon. Mrs. Bowes-Lyon, Admiral of the Fleet Sir Algernon Willis (Chairman, British North Greenland Expedn.) and Lady Willis, General Sir Cameron Nicholson, Adjutant-General to the Forces, and Lady Nicholson, Marshal of the R.A.F. Sir William and Lady Dickson, Professor Sir Mortimer Wheeler (President of the Society of Antiquaries) and Lady Wheeler, Sir Edwin Herbert (President of the Alpine Club), Sir Landsborough Thomson (President of the Zoological Society of London) and Lady Thomson, Sir Harold Jeffreys (President of the Royal Astronomical Society) and Lady Jeffreys, Monsieur Robert Perret (Vice-President of the Geographical Society of Paris), Sir John Russell (Victoria Medallist for 1955) and Lady Russell, Dr. John K. Wright of the American Geographical Society of New York (Patron's Medallist for 1955) and Miss Wright, Dr. H. Hamshaw Thomas (President of the Linnean Society) and Mrs. Thomas, Dr. D ouglas A. Allan (President of the Royal Scottish Geographical Society), Mr. L. S. Suggate (President of the Geographical Association) and Mrs. Suggate, Professor L. Dudley Stamp (President of the International Geographical Union) and Mrs. Stamp, Professor J. A. Steers (President of the Institute of British Geographers) and Mrs. Steers, Mr. E. D. Pugh (President of the Manchester Geographical Society) and Mrs. Pugh, Commander C. J. W. Simpson, D.S.C., R.N. (Leader of the British North Greenland Expedition, and Founder's Medallist for 1955), Mr. R. A. Skelton (representing the Hakluyt Society) and Mrs. Skelton, Mr. W. Campbell Smith (President of the Geological Society) and Mrs. Campbell Smith.

Before the company of 300 sat down to dinner,

The PRESIDENT said: Today I caused the following telegram to be sent to Her Majesty The Queen:

"On this, the occasion of the 125th Anniversary Meeting of the Royal Geographical Society, the President, Fellows and Members of the Society present to Your Majesty, our Patron, their humble duty and loyal greetings."

I have just received from Buckingham Palace the following message:

"Please convey to the Officers and Members of the Royal Geographical Society my sincere thanks for their kind and loyal greetings sent on the occasion of the 125th Anniversary Meeting of the Society. As Patron I greatly appreciate their message. ELIZABETH REGINA"

After the Loyal Toasts,

Admiral EARL MOUNTBATTEN said: May I say what an honour it is to be invited to propose the toast of "The Royal Geographical Society" on the 125th Anniversary. When I went up to Cambridge after the First World War as one of the so-called naval "war babies" to catch up with my education, I selected for the two voluntary courses the "History of Geographical Discovery" and "Ethnology." I studied the latter under Professor Haddon, a world authority, and as a result, instead of going into the Navy I could have gone straight into the Royal Geographical Society. My wife has been a Fellow of the Society for nearly twenty years, and she and I between us, sometimes together, sometimes separately, have been to practically every corner of the globe; so that we may claim to know something about practical geography.

We have in our family another connection with geographical discovery in that one of the earliest and keenest geographers, Sir Joseph Banks, married into my son-in-law's family.

It is well known by all here that the Royal Geographical Society was largely founded through the efforts and enthusiasm of Sir John Barrow, at that time the Secretary of the Admiralty. When he had been recommended for that post and went for his interview, the First Lord of the Admiralty was Lord Melville, a Scot, well known for favours to his fellow-countrymen. When Melville asked Barrow: "Are you a Scotsman?" Barrow, seeing his chances vanish, replied: "No, My Lord, only a borderer from North Lancashire," whereupon Melville said: "I am very glad to hear that; it is a real pleasure to find an Englishman thoroughly fitted for a post." Barrow, who in his Admiralty position was closely associated with the Duke of Clarence during the latter's period of office as Lord High Admiral, was able very quickly to get the prefix "Royal" for the new Society, for the Duke had succeeded to the throne as King William IV and became the Society's Patron a few weeks after its formation.

Barrow had travelled widely: as a boy he had joined a whaling expedition to Greenland; later, he was in China as "Comptroller of the Household" to Lord Macartney's Embassy. Then he went as private secretary to Macartney at the Cape of Good Hope, where he spent considerable time exploring Cape Colony, and the map he made of the territory was unrivalled for accuracy for many years. While at the Admiralty, Barrow was instrumental in persuading the First Lord to authorize numerous voyages of exploration and discovery, notably Parry's voyages to the Arctic in the *Hecla*, *Griper* and *Fury*, in 1821–25, in search of the North-west Passage. Barrow was one of the four first Vice-Presidents of the Society, and it is, perhaps, interesting to note that one of the members of the original Council was Captain Beaufort, at the time engaged in making Admiralty charts who in 1829 became Hydrographer of the Navy. Those who have been to sea will know what the "Beaufort scale" means.

The influence of Barrow in the new Society can be seen by a study of the first volume of the *Journal* of the Royal Geographical Society from 1830–31. Barrow himself read three papers, and of the ten others that were presented that year, seven came from naval sources, including one from Captain Beaufort and one from Captain Vidal, another famous naval surveyor.

In the days immediately following the Napoleonic Wars, many officers of the Royal Navy were unable to settle down into the dull routine of peace, and Polar exploration

offered an exciting and strenuous outlet for their energies. They were encouraged by Sir John Barrow, and two Admiralty-sponsored expeditions sailed in 1818, one to seek the North-west Passage and the other on a voyage of discovery toward the North Pole, through the Greenland Sea. From then onwards naval expeditions were almost constantly engaged in the Arctic, Antarctic, or both, until the Crimean War brought Admiralty-sponsorship for Polar expeditions to an end, for the time being. Prior to the Napoleonic Wars, the last Admiralty-sponsored Arctic exploration had been by Captain Phipps in the *Racehorse* in 1773, when he reached latitude 80° 48′ N. in the longitude of Spitsbergen.

From 1818 onwards many expeditions took place which time does not permit me to recount, but I would like to refer to the great Scott Expedition to the Antarctic in 1911–12. I was then at my preparatory school and followed news of the expedition with breathless interest. Even in those days I was struck by the fact that the expedition was a combination of sailors, soldiers and scientists, which seemed to me the right idea for a combined operation. In 1913, a year afterwards, I entered the Royal Naval College, Osborne, as a Naval Cadet, a couple of months before my thirteenth birthday. My mother kept my letters written at that period, and while on leave before taking up my present appointment I had the chance of looking through them, when I found this somewhat melodramatic and effusive passage, dated 19 October 1913: "On Friday night I heard the best lecture I have or probably ever will hear in my life." [Mind, I was thirteen years of age then!] "It lasted from 8 to 10 p.m. All the masters, officers, bluejackets, marines, instructors, stewards, some bluejackets from Portsmouth, the families of all these people and many more of the staff listened to it. It was given by Commander Evans on the Scott Expedition. We had hundreds of lantern slides and a whole cinematograph film on it. The clapping, yelling, stamping, cheering was uproarious. I have still got a sore throat from it. He is going to give us his Theodolite. The way he gave the lecture and spoke about the brave actions and how the two seamen saved his life was marvellous. By the bye Lashly, one of the men who saved his life, was an instructor here: the Chief Stoker on the Alpha." I saw Admiral Lord Mountevans (the lecturer on that occasion) only a fortnight ago at a Trinity House luncheon, and one can never see him without thinking of that glorious epic. Although that Expedition was technically a failure, it was a glorious failure, and I feel sure the heroism then shown inspired not only our generation but has inspired, and will continue to inspire, the younger generations as they come along. It was interesting to see in *The Daily Mail* of June 9 that a description of Alan Norman Cooper's action in walking out alone into the Sahara to try to save his companions in their wrecked car was put under a banner headline: "Captain Oates of the Sahara"—a striking tribute to the way in which the deeds and names of the heroes of Scott's Expedition remain alive in public memory.

The Royal Geographical Society played a worthy part in both World Wars. During the First World War a large section of the Naval Intelligence Division was accommodated in the Society's House to prepare Intelligence Handbooks. During the Second World War the Hydrographic Department of the Admiralty made great use of the Society's Library, particularly in connection with the plans for D-Day. In fact, many Fellows of the Society assisted in the preparation of the N.I.D. Handbooks. I am glad that the Society maintained that traditional link between exploration and the Royal Navy in getting the Admiralty to agree to the attachment of two young British Naval Officers to the first international Antarctic expedition, the Norwegian-British-Swedish Antarctic Expedition, 1949–52.

In 1952, the Society was the first and among the most prominent backers of the British North Greenland Expedition, for which the Admiralty lent Commander Simpson—this year awarded the Founder's Medal—as leader, and included several other Naval Officers in his party. Commander Simpson is the eighteenth officer in the Royal Navy to receive the Society's Gold Medal. He is joined this year in the list of medallists and recipients of awards by Captain O. C. S. Robertson, of the Royal

Canadian Navy, who has received the Back Grant. Included in the honours to Naval Officers are three officers of the United States Navy, Wilkes, Peary and Byrd, and, in 1940, one officer then serving in the R.N.V.R.—Glen.

Since 1830 the Royal Geographical Society has been a centre of British exploration and travel. The story is written in the famous names of the Gold Medallists of the past, and in the long list of expeditions supported by the Society. In the last twenty-five years alone, that list is particularly impressive. In 1930–31 there was Gino Watkins' expedition to survey the British Arctic Air Route, which blazed the trail for the regular trans-Polar flights recently inaugurated. From 1934–37 the British Graham Land Expedition to the Antarctic carried out the first extensive surveys there, of great value in support of British sovereignty over the Dependencies of the Falkland Islands. Then, just before the Second World War, there were Bagnold's Libyan Desert explorations, during which he made the maps which made possible the wartime exploits of the Long Range Desert Group. Since the War there has been an even greater expansion of exploration supported by the Society. As you know, there are a dozen or more University expeditions each year. My wife and I are, incidentally, great believers in the British Public Schools expeditions and we have sponsored a Sea Scout for one of the expeditions and a Naval Cadet for another.

Apart from these there has been the Norwegian-British-Swedish Expedition and the British North Greenland Expedition, to both of which I have referred; Wilfred Thesiger's remarkable crossings of the Rub' al Khali—the Empty Quarter—of south-east Arabia, and his other solitary explorations there which have filled in large blanks in the map. And then the various Himalayan expeditions, in association with the Alpine Club, starting with Shipton's discovery of the southern route to Everest in 1951 and culminating in 1953 in the conquest of Everest, the "Third Pole," by Hunt, Hillary, Tenzing and others, on Coronation Eve.

Now it is the turn of the Antarctic again. It was the Society that first gave backing and financial aid to the organizers of the projected Commonwealth Trans-Antarctic Journey. This expedition is to start next winter on the first stage of the first land crossing of the "Last Continent" whose vast area is still largely unexplored. I am glad to note that one of my old cruiser Captains, Rear-Admiral Parry, who is with us tonight, is the General Secretary of the Expedition. He tells me that its aim is primarily exploratory and scientific in an unknown and unexplored continent of some 5¼ million square miles, equal in area to Europe and the U.S.A. combined. I understand that the general plan is to cross Antarctica from Vahsel Bay in the Weddell Sea to MacMurdo Sound in the Ross Sea via the South Pole—a distance of some 2000 miles right across Antarctica, a project originally envisaged by Shackleton more than forty years ago. New Zealand will play a large part in setting up the base at the Ross Sea end, and it is hoped that material assistance will be forthcoming from Australia and South Africa, thus making the whole a truly Commonwealth venture.

At the moment the Royal Navy is helping with three expeditions, having received official invitations so to do through the Defence Services Research Facilities Committee of the Royal Society. Two of these expeditions have received the blessing of the Royal Geographical Society, of which one is the Oxford University Expedition to North East Land; the landing of this party is being combined with an oceanographical cruise this summer by our latest surveying ship, *Vidal*. The second expedition is the Gough Island Scientific Survey led by Mr. Heaney, whose father, incidentally, was with me in South-east Asia as Director of Survey of the Allied Land Forces. In this case the Commander-in-Chief, South Atlantic, has a frigate which will combine the landing of the expedition, itself a useful exercise in seamanship and boat-work, with a call at the little-visited island of Tristan da Cunha. The third is of more concern to the geophysicists studying the earth's crust, and in this case Her Majesty's Submarine *Acheron* is carrying instruments in order to make gravity measurements under the direction of a scientist from Cambridge. The submarine is carrying out a training cruise by way of the Cape to Trincomalee and back through

the Mediterranean, thereby covering ground never previously examined by gravity observations.

Lastly or, rather, finally—I make the change because I have in mind a verger's comparison of the way in which the vicar and the curate preached their sermons: "With the curate, when he says 'Finally' you know that's the end; when the vicar says 'Lastly' you know he will last a lot longer." So, finally, may I say this? The Admiralty in the past has always taken the greatest interest in, and normally had the closest connection with, all voyages of geographical discovery. I can assure the Royal Geographical Society that this policy will continue and that we shall always be glad to help to the best of our ability in all voyages of exploration and geographical discovery. So, ladies and gentlemen, I ask you now to rise and drink to the toast of "The Royal Geographical Society," coupled with the name of its President.

The PRESIDENT, in responding, said: That eloquent and inspiring tribute by Lord Mountbatten to our Society gives us cause for both gratification and pride. We are gratified by the First Sea Lord's appreciation of our past achievements and our present endeavours. We are proud of having been suckled in infancy by the Royal Navy, presumably on salt water. That suckling process took place a good many years ago, since when a good deal has happened.

But a century-and-a-quarter is not a very long span for the life of a learned Society. In fact, we seem rather a teen-ager compared to the veteran of all learned institutions, the Royal Society, founded 295 years ago in the reign of King Charles II. The official date of the Society's foundation is 1830, but our roots really go deeper than that, for in 1778 a remarkable young man named Joseph Banks was at the age of thirty-four elected President of the Royal Society. Joseph Banks is probably better known as a botanist than a geographer; he was, in fact, one of the seven Founder Members of the Royal Horticultural Society in 1804. He gave his name to the genus *Banksia* of Australian evergreen shrubs, and I believe the beautiful Banksia rose was named after his wife. But Banks, apart from being a botanist, was a keen and experienced geographer. In 1768 he had at his own expense accompanied Captain Cook on an adventurous three-year voyage round the world. You will remember that the Admiralty, in conjunction with the Royal Society, send out Cook in command of H.M.S. *Endeavour* to observe the transit of Venus in the island of Tahiti, and on the homeward voyage they, for the first time, charted and explored scientifically the eastern coasts of New Zealand and Australia. Then in 1788 Sir Joseph Banks (for he had been created a Baronet in 1781) founded a small society for the encouragement of exploration, to which he gave the somewhat cumbrous title of "The Association for Promoting the Discovery of the Interior Parts of Africa." In 1795 this African Association sent out Mungo Park to explore the course of the Niger, and, in spite of its restrictive name, also supported the exploration of Central Asia and the Polar regions.

Sir Joseph Banks, President of the Royal Society, had a very definite idea of the prerogative of that Society as being the focus for all research in geography and geophysics. I hesitate to say anything in criticism of Sir Joseph Banks, because I did not know until this evening that he had anything to do with the First Sea Lord. However, during the life of Sir Joseph Banks nobody dared mention the idea of forming an independent geographical society. In fact, our Society was not founded until ten years after Sir Joseph Banks' death, but within a year of our Society's foundation his African Association voluntarily merged with us, passing on its archives and records to this Society, so we can claim that our tradition in regard to the encouragement of exploration dates back to the year 1788—167 years ago.

The Royal Geographical Society started its career in 1830 under the patronage of our sailor King, William IV, with 460 Fellows. Of the 29 Fellows who formed its first Council no fewer than 18 were Fellows of the Royal Society, which indicates that at any rate our Society had then obtained the blessing of that august body. The First Sea Lord has mentioned two of our Founder Members more closely connected with the Royal Navy, Sir John Barrow and Captain H. W. Smyth. I would like to mention

a third, the youngest of them and perhaps the most remarkable, Roderick Impey Murchison.

Murchison was a Highlander by birth and a soldier by early training. As a very junior subaltern he got his commission at the age of fifteen—two years later than the First Sea Lord—and he served with a Line Regiment under Sir John Moore in the Peninsular War. After the battle of Waterloo he became tired of regimental soldiering, resigned his commission and settled down at Melton Mowbray to the life of a fox-hunting squire, varied with bouts of foreign travel.

At the age of twenty-eight Murchison developed a strange passion for geology, under the influence of Sir Humphry Davy, and very shortly became one of the most eminent geologists of his day. It was Murchison who established the Silurian and Permian systems of classification for the Palaeozoic order of rocks. However, Murchison's principal interest in life was geography, and he was a great President of this Society. Its welfare was very much at his heart; he was *par excellence* the promoter of exploration. He was a staunch supporter of David Livingstone during the course of his Central African journeys, and he very ably seconded Lady Franklin in the relief expeditions she sent out to the Arctic seas in search of the *Erebus* and *Terror*. Murchison achieved the record of being elected for four separate terms of office as President of the Society, and occupied the presidential chair altogether for sixteen years. When Murchison finally retired in 1871, shortly before his death, he had seen the Fellowship of the Society trebled, from 700 to 2300.

I must mention one other name in connection with the Society's foundation, that of Major James Rennell, one of the greatest geographers of his day. From the age of fourteen he served for seven years afloat as a midshipman in the Royal Navy. He specialized in marine survey and hydrography and established such a reputation as a surveyor that at the age of twenty-one the Honourable East India Company offered him a commission as a lieutenant in the Bengal Engineers, and appointed him Surveyor-General of Bengal. There during the succeeding years he personally mapped out the greater part of the Ganges basin and laid the foundations for the cartography of our Indian possessions. Rennell was a geographer of very wide interests and great accomplishment; he has been called the "father of oceanography." He was elected a member of the Institut de France. He was one of the foremost advocates for creating a Geographical Society but, unfortunately, died four months before this was achieved in 1830, otherwise we could have counted him as one of our Founder Members. He was buried in Westminster Abbey; I am happy to say that his great-great-grandson, Lord Rennell, is present with us tonight. Lord Rennell, himself a distinguished explorer and geographer, is one of our Vice-Presidents and a past President of the Society.

But I am reminded of and must be guided by that cautionary rhyme by E. C. Bentley:

> "The art of Biography
> Is different from Geography;
> Geography is about Maps
> But Biography is about Chaps."

I have told you enough about the Chaps; let us now turn to the Maps.

The Society has in its Map Room and map store some 400,000 maps—an unrivalled collection. I recently asked our Map Curator, Mr. Crone, to show me the maps used by our Founding Fathers. He at once produced two atlases—Cary's of 1828 and Hall's of 1830, in both of which, despite the efforts of the African Association, the interior of Africa is shown as almost completely blank. In those days the sources of the Nile, the Congo and the Zambesi had not been located, and on the map of 1828 the Niger is shown as debouching into an inland swamp. In fact, it was not until 1829 that Richard Lander, by means of a hazardous canoe journey, discovered that the Niger finds its way out to sea in the Gulf of Guinea. For that discovery he was in

1832 the first recipient of our Royal Premium, the forerunner of our Patron's and Founder's Medals.

In fact it may be said that the map of Africa in 1830 was not very different from what it had been 150 years earlier, when Swift so neatly satirized the zoological embellishments used by seventeenth-century cartographers:

> "Geographers in Afric maps
> With savage-pictures fill their gaps;
> And o'er unhabitable downs
> Place elephants for want of towns."

Those gaps in the map of Africa were a definite challenge to our youthful Society. Between 1850 and 1870, during the great days of Roderick Murchison's presidency, the Royal Geographical Society sent out expedition after expedition, through jungles, through forests, up the great rivers, to find the great central lakes. The pioneers of those expeditions are familiar to us all, apart from the fact that their names are printed in letters of gold round the walls of the Society's Hall—Livingstone, Speke, Burton, Grant, Baker, Thomson and others. The gaps in the map of Africa were gradually filled up. Just one hundred years ago—in 1855—David Livingstone discovered the Victoria Falls, and in the same year he was awarded the Patron's Medal. In 1873, the year in which Livingstone died, the Patron's Medal was awarded to Henry Morton Stanley. On the Emin Relief Expedition of 1887–9, to which the Society contributed £1000, Stanley forced his way up the Congo and its tributary, the Aruwimi, and discovered Ruwenzori. We then struck a special Gold Medal in Stanley's honour. The Society sent out expeditions to Arabia, Central Asia, Australia and to South America, all of which were explored and mapped, while numerous expeditions to the Polar regions were launched or sponsored. In fact, the map of the world today, compared to Hall's Atlas of 1830, is the best monument to our Society's achievements in the field of exploration and cartography.

But apart from its encouragement of exploration, survey and mapping, our Society has been responsible for the great advances made during the past century in the improvement of geographical teaching in our universities and schools. This development has been of slow, but steady growth, the pioneers of the movement being Douglas Freshfield, Francis Galton, John Scott Keltie, Halford Mackinder. Between 1887 and 1924 the Society spent more than £20,000 in establishing geography as a part of university teaching in this country. Our efforts proved successful. In 1899 a School of Geography was opened, for the first time, in Oxford University, followed four years later by the Department of Geography at Cambridge. Today there is a Geography Department in every British university. It only remains for us to establish more geography scholarships in our university colleges. The Geographical Association was founded in 1893 to promote the education of geography teachers.

But we must record our setbacks as well as our successes. For several years I have tried in vain to get geography established as a taught special subject in the curriculum of the Royal Military Academy, Sandhurst. Surely in the soldier's profession, above all others, a knowledge of geography is a basic essential? Unfortunately, neither the present nor the future C.I.G.S. could be with us tonight, but we have here the Adjutant-General to the Forces and not far off I espy the Vice-C.I.G.S. I hope those two distinguished officers will take out a pencil and make a note on their shirt cuffs.

Lastly, a word about our Lady Fellows. In the good old Victorian days ladies, of course, were not admitted to the privilege of our Fellowship. But as far back as 1847 a still small voice was heard: one gallant Fellow, possibly a hen-pecked husband, proposed that ladies should be admitted to Fellowship at the reduced subscription of one guinea. That proposal met with a very cold reception by the then Council, who recorded in a terse Minute: "This is not deemed expedient at present."

In fact no progress was made until the final decade of the nineteenth century, a decade which, for some reason hidden from me, has been called "The Naughty

'Nineties." In 1892 the President (Sir Mountstuart Grant Duff) persuaded the Council, after considerable opposition, to pass a resolution in favour of admitting ladies to Fellowship. Unfortunately, that was subsequently rescinded at two very stormy Special General Meetings. One member of our Council was so indignant and felt so strongly about the proposal that he wrote a letter to *The Times*, denying "the ability of women to contribute in any way to scientific geographical knowledge." The name of that Fellow was George Nathaniel Curzon.

Twenty years later, in 1912, Lord Curzon was President of the Royal Geographical Society, and one of our greatest Presidents. During those twenty years Lord Curzon had exercised the feminine privilege of changing his mind, and in 1912 he was all in favour of Fellowship for women. He caused a referendum to be held throughout the Society, as a result of which over 2000 Fellows voted in favour of admitting women Fellows and 674 Fellows voted against. I feel I must now make an abject confession—I was one of the 674 who voted against. But I was a bachelor then. The question was submitted to a Special General Meeting of the Society in January 1913, and the proposal was finally adopted by 130 votes to 51. Like Lord Curzon, I have changed my mind, and I am very happy to announce that sitting opposite to me is one of Lord Curzon's daughters, a member of our Council. I am also glad to announce that of our 6500 Fellows today—and that in itself is an all-time record—over 20 per cent. are ladies, and of our Associate Members, mostly geography students at Universities, over 50 per cent. are ladies. May those proportions increase!

Now, my lords, ladies and gentlemen, I have tried to give you, not a geodetic survey, but a quick compass-traverse over a wide field of activities during the past hundred and twenty-five years and more. During that period much has been accomplished in the geographical field. The Poles have been reached; Everest, K2 and now Kanchenjunga have all been climbed. But let us not sit down and lament the lack of future targets. For us geographers the earth and all that is therein, yes and the waters round and under the earth, affords an inexhaustible field for research, perhaps more specialized than in the past, possibly less spectacular, but none the less important for the advancement of man's knowledge about this world in which we live. Our Society can look back on worthy traditions and on solid achievements. Let us now go forward in the same pioneer spirit as in the past, using new methods and following fresh trails, to meet the challenge of what still remains unexplored and unexplained.

The Lord Bishop of Portsmouth (Dr. W. L. S. Fleming): I have regarded it as a great honour to be asked to propose the toast of "The Medallists," but when I came to consider the talents and the interests which they possessed, it placed me in what I can only describe as a schizophrenic condition, schizophrenic in the sense of the limerick which, possibly, is well known to you but was only learned by me recently from my Assistant Bishop:

> "There was an old Colonel of Kenya
> Who was told that he had schizophrenia,
> It wasn't the word
> Which fogged the old bird
> But which of his egos was senior."

Geographers have never regarded as an embarrassment that no one really quite knows where the science of geography begins and ends. The width of its scope and therefore of this Society's interests are well represented by this year's Medallists, Dr. John Wright representing academic geography, Commander Simpson travel and exploration and Sir John Russell one of the several subjects allied to geography, soil science, for which this Society will always hope to provide a forum. Sir John Russell, who was for thirty-one years Director of Rothamsted Experimental Station and for fifteen years Director of the Imperial Bureau of Soil Science, has achieved international distinction. He has received Honorary Degrees of at least eleven Universities from seven countries. His work has contributed in a singular way to the

relationship between science and the use of the land for agricultural and other purposes. His recent great book, published only last year, on 'World Population and World Resources', epitomises his life's work and deals with what is one of the most important of international problems and one which is of vital concern to all economic geographers. We honour him this evening as the recipient of the Victoria Medal.

The Founders' Medal goes to Commander Simpson, the leader of the British North Greenland Expedition 1952–4. Commander Simpson was in effect preparing for his task in a specialized sense for at least five years before his expedition set sail, and he is to be congratulated on the energy and the resilience which he displayed in successfully organizing such an ambitious venture. He was helped in a good many ways. The Expedition received Royal patronage; it received the support of the Services; and I am sure that this Society is particularly gratified to hear what the First Sea Lord has said about the continued and, indeed, increasing support which is being given by the Senior Service to Polar exploration. Not only was Commander Simpson as a Naval Officer the leader of the Expedition, but Admiral of the Fleet Sir Algernon Willis was Chairman of its Committee. Then the Expedition received support by air supply and air drops from Sunderland and other aircraft of the Royal Air Force. And again it is most gratifying to the Society to realize the extent to which the R.A.F. is assisting geographical exploration and research. The Expedition also had the cooperation of the Merchant Service, so admirably represented in the membership of the party, the financial assistance of industry and, in particular, of the Shell Oil group, in addition to the sponsorship of the Royal Society, the Scott Polar Research Institute and the Royal Geographical Society. But in spite of all that, it was no mean personal feat to launch so large and varied a party with modern means of transport and new techniques, and a varied programme of research and exploration. I had the good fortune to visit the Expedition at its base in Greenland during the air drop at the end of the first year. My only regret is that I have so far failed to find an appropriate ecclesiastical formula by which that magnificent country might be contained for the purpose of the Church of England within the See of Portsmouth! The scientific and the technical results of the Expedition are still being worked out, but we had some indication of what that party had achieved in the admirable lectures which were given by Commander Simpson and other members of the party. The Society is proud to add the name of another leader in Polar exploration to its list of Medallists.

Lastly—I use that term in the vicar's sense because I am not really quite finished!—the award of the Patron's Medal to Dr. John Wright is significant in two respects. In the first place, it reflects the Society's interest in academic geography. The President has referred to the fact that one of the constant concerns of this Society is the promotion of the teaching of geography in Schools and Universities in the belief that it is in the best interests of a full education, and Dr. Wright is primarily an academic geographer. Secondly, this award reflects the friendly relationship which has always existed between the Royal Geographical Society and our sister Society across the Atlantic, the American Geographical Socirty of New York. Dr. Wright was a servant of that Society for thirty years, and he was its Director from 1938–49. He was also at one time editor of research publications. Dr. John Wright was educated at Harvard. I want to be magnanimous, and as a graduate of Yale I can quite honestly say that Harvard is at least the second best University in the United States! Dr. Wright's publications cover a wide field, but are mostly concerned with historical geography in one form or another. They vary from, for instance, a treatise on Geographical Lore at the time of the Crusades,' for which Dr. Wright learned Arabic, to 'A Memoir on the Geographical Foundations of National Power' which was used for the basic course in the United States Army specialized training programme during the last war. Dr. Wright also wrote an excellent History of the American Geographical Society, which that Society published for its centenary in 1951. There have, as I said before, been most friendly relations between our two Societies with, I also think, the appropriate stimulus of healthy rivalry. The award to Dr. John Wright of the Patron's

Medal has been conferred, not only as a tribute to his distinction as a geographer, but as a mark of the part that he has played in extending the good relations which have existed between our two Societies over the past century. I ask you to drink the toast of "The Medallists," coupled with the name of Dr. John K. Wright.

Dr. JOHN K. WRIGHT, in responding, said: Mr. President, My Lord Bishop, My Lords, Ladies and Gentlemen,—I feel an impulse to say something with regard to Harvard and Yale, but I shall desist. I am sure that Sir John Russell and Commander Simpson would wish me, in replying to this very graciously proposed toast, to try to express our sentiments with regard to the Royal Geographical Society, which has honoured us so signally. But that is not a very easy thing to do. The sentiments are personal and deep. I shall try, instead, to symbolize what the Royal Geographical Society means to all of us by saying a few words in regard to what the Royal Geographical Society has meant to its younger sister in New York.

I think I can say, without qualification, that there is no other institution in the world, with the exception of the Government of the United States, which has exerted a stronger influence on the American Geographical Society than has your Society. This of course means that the indirect influence of the Royal Geographical Society on the progress of geographical studies in the United States has been very powerful.

Imitation is the sincerest form of flattery, and my Society showed superlatively sincere flattery in 1854 when it called its governing body a Council; and again in 1874 when it began to call its members Fellows. In 1916 my Society modernized its periodical and gave it a more attractive title than it had hitherto held, which was precisely what your Society had done not very long prior to that. In 1922 my Society set up its own school for exploratory surveying, modelled on yours, and it secured a young Scottish war veteran to head its school. This was Mr. O. M. Miller who had taken the Royal Geographical Society's diploma under your Mr. Reeves. Mr. Miller is still with us. He now has an international reputation in the fields of cartography and photogrammetry, and he is the Society's most outstanding gift to America.

This next remark on my notes I thought was going to be very impressive: it is that for more than one hundred years our two Societies have worked together, honoured each other and commented upon each other in countless ways, but since the President has spoken of one hundred years as practically no time, I cannot now regard that remark of mine as so impressive. At any rate, we have cooperated in many ways; we have even indulged in sisterly bickerings at times, though very long ago and very seldom; indeed, I could possibly disclose some examples of imitation in the reverse direction, but I shall not do so.

For forty-five years until his death in 1899 a highly versatile and learned man, Judge Charles Patrick Daly, was President of the American Geographical Society. Our Society would probably have expired shortly after the War between the States had it not been for Judge Daly's interest and support. In 1895, when he was seventy-eight years old, Judge Daly represented the American Geographical Society at the Sixth International Geographical Congress held in London. Your Society organized and ran that Congress. I have here in this envelope a letter which Judge Daly mailed to the scholarly Librarian of the American Geographical Society a few days after the Congress, and I should like to read a sentence or two from that letter: "A great honor was conferred upon me and our Society. I was selected to make the reply on behalf of the delegates and foreign visitors of the Congress to the Duke of York's and the President's address of welcome . . . at the ceremonial opening. . . . I confess I was very nervous when I took my seat . . . in the great Hall of the Imperial Institute facing the platform which presented a gorgeous sight with the diplomatic representatives from all parts of the world covered with orders and decorations. . . . Fortunately, I got through better than I expected. . . . *The Times* . . . has endorsed it as 'felicitous' and another leading journal said 'The *venerable gentleman* made a happy reply.' " Mr. President, on behalf of the American Geographical Society I should like to present to the Royal Geographical Society the original letter from Judge Daly as a token of our

esteem and as a memento of a very kindly Judge who was one of the staunchest American friends of your Society for more than half a century. I am also handing you an accompanying letter from Dr. Richard Upjohn Light, our present President.

Major-General R. Ll. BROWN: Mr. President, My Lords, Ladies and Gentlemen,—I am not at all sure that we would not express our feelings to our guests a great deal more sincerely and effectively than by speechifying if we stood up and gave them a good cheer. But that is not our way. There is a certain reticence, a certain British phlegm, that makes us shy of such demonstrations. Yet we would like our guests to know how very warmly we feel towards them.

I suppose everybody nowadays has some interest in geography, even if it is only in a quite simple context, such as to know where the nearest pub is; how far it is to it, and whether it will be uphill all the way—which we may call perhaps physical geography—and also to know whether it will be open when we get there, which we may call, perhaps, human or economic geography. In consequence, the Royal Geographical Society, which deals in matters geographical in a much wider aspect and, as our President told us at the Annual Meeting this afternoon, quoting one of his eminent predecessors, is a "representative institution of the wider life of the nation"—whatever that may mean—the Royal Geographical Society has a great number of friends scattered throughout the country and, indeed, in every quarter of the globe, and we are delighted that so many of them have found it possible to be present with us this evening at our Annual Dinner when we are celebrating the Society's 125th Anniversary. The list of guests is long and imposing. They are very eminent and I have been ordered to be brief. By one of those tricks of fate the number of official guests of the Society—not counting those whom the Fellows have brought as their own private guests—add up to exactly fifty-two. Like a pack of cards, I have taken them and shuffled them and, with a certain sleight-of-hand, I have brought some cards to the top and left others at the bottom. I am hoping thereby to deceive those who are not mentioned into believing that it is a matter of chance and equally, rather hopelessly, to deceive those whom I do mention into thinking it is a matter of pre-selection.

I must start with those who are representatives of our sister Geographical Societies, and the first of those that I wish to mention is the Geographical Society of Paris, represented by Professor Robert Perret. That is the oldest Geographical Society of modern times, and its establishment led to the formation of a Society at Berlin nine years later, and of our own Society in London two years after that. Then there is Dr. John K. Wright, of whom we have already spoken, from the American Geographical Society of New York, and while our minds are overseas let us bring them half-way back to the present President of the International Union of Geography, Professor Dudley Stamp. Then two close sister Societies are the Royal Scottish Geographical Society and the Manchester Geographical Society, both represented this evening by their Presidents, Dr. Douglas Allan and Dr. Pugh. To finish off the sister Societies I ought to mention the Hakluyt Society and the Institute of British Geographers, represented by Mr. R. A. Skelton and Professor J. A. Steers.

Now we come to the kindred learned Societies, which are represented this evening among our guests in considerable numbers. Perhaps I can deal with those in one fell swoop by mentioning the father and mother of all the learned Societies of Great Britain, the Royal Society. We are delighted to see with us the President of the Royal Society, Lord Adrian of Cambridge. It must be unusual for the President of the Royal Society to find it possible to dine with us at our Annual Dinner on two years in succession and not only to do that but to arrive at each in different guises. Last year, you will remember, Professor Adrian came to us as the Master of Trinity College, Cambridge; this year Lord Adrian of Cambridge arrives. Geographically speaking, I suppose we may say he has enlarged his region and, of course, climbed to heights not visited by most ordinary mortals. There I ought to call a halt on the kindred Societies, but I cannot resist referring once more to the Royal Horticultural Society, because 125 years ago the first public meeting of the Royal Geographical Society was

held in the rooms of the Royal Horticultural Society at 21 Regent Street, and for ten years after that we enjoyed the use of their Hall and their rooms. Having made one exception I must, perforce, make another, for the Alpine Club, represented here this evening by its President, Sir Edwin Herbert, who has done an enormous amount of work in cooperation with the Royal Geographical Society.

We have also with us a number of distinguished officers of the three Fighting Services and we are very glad to see them. The Society owes a great deal to the Services for encouragement and help in many directions over many years. One likes to think that the keynote of our relationship with the Services is one of understanding cooperation, which indeed it is; but while they might not seriously notice any lack of help on our part, we would notice most markedly any lack of sympathy from them.

As I have said, the Services have done a great deal for us. Over recent years the Norwegian-British-Swedish Antarctic Expedition, 1949–52, had with it two Naval Officers; the R.A.F. produced a couple of Austers and their crews for the British North Greenland Expedition, 1952–54, and the Chairman of their Committee, Admiral of the Fleet Sir Algernon Willis, is with us this evening. The Navy produced naval personnel and the R.A.F. let a flying boat. On the last Everest Expedition, you may remember, there were two serving officers, Hunt and Wylie. In the forthcoming Antarctic journey all the Services are interested, and will all probably play some part. We are much indebted to the soldiers, sailors and airmen of this country. I like to put them in that order—it puts the Army in its proper place. We have with us representing the Services, the First Sea Lord, Admiral Earl Mountbatten; the Adjutant-General, Sir Cameron Nicholson, and the Chief of the Air Staff, Marshal of the R.A.F. Sir William Dickson.

Lastly, I must mention the distinguished guest who is going to reply to this toast, Sir Mortimer Wheeler. We are delighted to see him and shall be even more delighted to listen to him. Now, emulating the curate, I come to finally—finally, there is a whole category of guests whom we should like to welcome and say how pleased we are to see them here. I am not sure that in a Society such as this in which, as has been said, the membership is so mixed, I ought to say anything about them at all, but I will chance it; that category of guests is, of course, the ladies. We are delighted to see so many of them here with us; they lend a great charm to our proceedings and also, I think, a certain propriety to our speeches.

Professor Sir MORTIMER WHEELER: My responsible task is to thank General Brown and the Royal Geographical Society, on behalf of a very distinguished list of fellow guests, for hospitality on this notable occasion. The Royal Geographical Society, as we know, this evening celebrates its 125th Anniversary, and if my mathematics are correct—they usually are not—that implies that the Society was founded in 1830. But I like to think that for some years before that date its foundations were already being laid, as those of a sodality should be, in the good honest beef and burgundy of a Dining Club. That these foundations were well and truly laid is manifest in the sumptuous superstructure which we witness here this evening. A good dinner was ever the proper preamble to good discourse and good discourse was of the very nature of Georgian and Regency learning.

Like the Royal Geographical Society, my own Society of Antiquaries, and indeed several others, began as dining clubs. I recall the remark by Joseph Addison that the English "take all occasions and pretences of forming themselves into those nocturnal assemblies which are commonly known by the name of clubs. When a set of men find themselves agree in any particular, though never so trivial, they establish themselves into a kind of fraternity, and meet one or twice a week upon the account of such a fantastic resemblance." Addison made that remark in 1710 and already, three years before that date, the Founders of the Society of Antiquaries had begun their weekly meetings at the Young Devil Tavern in Fleet Street. Attendance was compulsory on pain of the forfeit of sixpence, and one of the Founders was a Fellow of the Royal Society who was able to "combine unitarianism with joviality." The Society of

Antiquaries was, in fact, the first of the learned Societies which gradually hived off from the Royal Society as time went by.

The subject of Antiquity had been from the outset the Cinderella of the sciences, and in the Royal Society's statement of its aims and objects, issued in 1718, "Antiquities" are placed at the very end after "Husbandry, Gardening and Planting," an association which reminds us (as indeed the President has told us) that the Royal Horticultural Society was the original host of the R.G.S. in Regent Street over a century ago. Nevertheless, there was even in the time of Queen Anne a growing appreciation of the study of man's achievement in perspective, and in 1714 it was solemnly affirmed that "to know nothing before we were born is to live like children and to understand nothing but what directly tends to the getting of a penny is to live the life of a sordid mechanic." Today, when our Minister of Education is, very properly, asking for more and more "sordid mechanics," there is more need than ever before to preserve a just perspective of human endeavour, its past, present and future; in other words, to enlarge the study of the Humanities. That humanistic perspective implies space as well as time. It implies the R.G.S. as well as history, archaeology and geology.

I do not want to labour the incidence of the studies which I represent, but I am glad to use this opportunity to express appreciation of the liberal and humane fashion in which the R.G.S. has interpreted its geography. Today the Humanities are increasingly aware of their debt to the Sciences and, were it proper, I could give numerous examples of the practical and steadfast manner in which the Royal Geographical Society has acted as a bridge between the two. I prefer, rather, to emphasize one special aspect of the continued work of the R.G.S., the aspect which it happens to share with the Society which I have the honour to represent. That aspect is the encouragement of a sense of adventure. Adventure was ever a British export; but during the past ten years the more obvious fields for its employment in great Asian or African territories have been closing in. Today the more obvious outlets for our adventurers are appreciably less than they were, but Societies such as yours and perhaps my own can do much to fill the widening gap.

The fact that we can now climb mountains in helicopters fails to alarm me. Some may think that the mountains have now "had it." I for one do not believe that they have. But there are many other objectives equally adventurous, and in the encouragement of intelligent adventure I submit that the R.G.S. has a moral mission even more profoundly significant today than that of academic discovery.

But I must remember that this is not a private discussion between two kindred learned Societies; I am aware that my fellow guests have many interests outside our own, and I must not monopolize the scene. General Brown has reminded us of some of their various and formidable distinctions. I am replying, on the one hand, as he has reminded us, for the oldest Geographical Society in the world, the Paris Geographical Society and, on the other hand, I speak for one who, above all, has helped to establish our new political geography for us. It was my fortune to serve in India throughout Lord Mountbatten's Viceroyalty, but I will merely say this: on that August day in 1947, when the Union Jacks were hauled down at New Delhi for the last time, the Indian crowd surged round Lord Mountbatten's carriage and shouted the very highest possible tribute to him: "Jai Mountbatten"—"Victory to Mountbatten." Lord Mountbatten in the course of his eminent and adventurous career must have had many finest hours. That was certainly one of them. I can only add that at least one spectator felt a trifle hot about the eyes at that moment. With Lord Mountbatten one must also associate his gracious wife, to whom the friendly outcome of that difficult episode in India owed so much.

For Lord and Lady Mountbatten and my other fellow guests I thank the R.G.S. for their hospitality. I will not now express the hope that the R.G.S. may reach greater heights, unless space-travel comes within its purview, but I wish it increasing strength and ever heightened glory. Mr. President and General Brown, thank you.

THE ROYAL GEOGRAPHICAL SOCIETY

KENSINGTON GORE, LONDON, S.W.7

FELLOWSHIP AND ASSOCIATE MEMBERSHIP

The object of the Society being the Promotion and Diffusion of Geographical Knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support, as well as those able to take a more active part in the work of discovery and exploration.

FELLOWSHIP

The Bye-Laws provide that a candidate for admission to the Fellowship of the Society must be proposed by a Fellow personally known to him and seconded by another Fellow. Further, that a candidate is not eligible until he (or she) is twenty-one years old, unless he holds a Commission in Her Majesty's Forces or he (or she) is a matriculated student of a University of the United Kingdom or the Self-Governing British Dominions. Proposal forms can be obtained on application to the Director and Secretary.

Every Fellow shall be required to pay on election *either* £4 as Entrance Fee and £4 as Annual Subscription for the current year and thereafter an Annual Subscription of £4 due on 1st January in each year; *or* a single compounding fee of £60.

The Entrance Fee and first Annual Subscription may be paid in four quarterly instalments of £2 each; *or* the Entrance Fee and first two Annual Subscriptions may be paid in four half-yearly instalments of £3 each. Thereafter the Annual Subscription may continue to be paid in four quarterly instalments of £1 each or two half-yearly instalments of £2 each respectively. Entrance Fee and Annual Subscription may be paid by instalments only where payment is made by Banker's Order. Half-yearly instalments shall be due on the 1st January and the 1st July; quarterly instalments shall be due on the 1st January, 1st April, 1st July and 1st October.

For Fellows who are under the age of 25 years on election the Entrance Fee shall be reduced from £4 to £2. The Entrance Fee and first Annual Subscription may be paid in four quarterly instalments of £1 10*s*. 0*d*. each *or* the Entrance Fee and first two Annual Subscriptions may be paid in four half-yearly instalments of £2 10*s*. 0*d*. each: thereafter payment may be by instalments as above. Entrance Fee and Annual Subscription may be paid by instalments only where payment is made by Banker's Order.

Fellows may compound for their Annual Subscriptions at any subsequent time by a payment of £60 less £2 for each Annual Subscription paid in excess of five with a minimum of £20 after 25 payments.

No Fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear.

ASSOCIATE MEMBERSHIP

The Bye-Laws covering the terms of Associate Membership provide that—

1. *A candidate must be not less than 17 and not more than 20 years of age. He (or she) must be recommended by a Fellow, University or School authority.*

2. *Subscription shall be £2 per annum without Entrance Fee.*

3. *On attaining the age of 21 Associate Members become eligible for Fellowship. The Entrance Fee of £2 shall be waived provided they have been Associate Members for 3 years. Otherwise Associate Membership shall cease at the age of 21.*

All subscriptions are payable in advance, on the 1st of January in each year.

PRIVILEGES OF FELLOWS AND ASSOCIATE MEMBERS

The privileges of a Fellow or Associate Member include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Society's House, Library and Map-room. Each Fellow is also entitled to receive a copy of *The Geographical Journal*. Associate Members have the choice of receiving either *The Geographical Journal* or *The Geographical Magazine*. Associate Members may not describe themselves as F.R.G.S. and have no vote at Annual or Special General Meetings.

A pamphlet giving details of the Society and a copy of the Charter and Bye-Laws will be sent on application to the Director and Secretary.

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